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TRANSLATIONS ON CONSTRUCTION AND PRODUCTION OF COMMUNIST CHINA'S CHEMICAL INDUSTRY

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FOREWORD

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TRANSLATIONS ON CONSTRUCTION AND PRODUCTION OF COMMUNIST CHINA'S CHEMICAL INDUSTRY

/Following are translations from various 1959 issues of the Hua-hsueh Kung-yeh (Chemical Industry), Peiping. Articles are grouped according to source date; page and author are given under article headings./

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1. The Road Toward Rapid Development of the Chemical Industry

Wu Liang-p'ing

Pages 2-6 (excerpts)

All the people are happily celebrating the Tenth Anniversary everywhere. The entire staff and workers of our country's chemical industry are also enthusiastically responding to the slogan of the Party's Eighth Plenary Session with regard to the movement for raising production while making savings. We are achieving outstanding results in production and construction to welcome this important event.

During the last ten years, our country's chemical industry went through three important stages, namely, the rehabilitation stage, the First Five-Year Plan stage, and the stage encompassing 1958 and 1959. As a result of the correct leadership of the Party and the Central Government, our country's chemical industry has made rapid strides in development within a short period of ten years. During the First Five-Year Plan period the total value of output by the chemical industry increased nearly three times and the type of products produced was raised from a little over 270 to more than 1,500. In these five years, the large scale and modern chemical base in Kirin was established. Four other chemical bases at Lanchow, Taiyuan, Shih-chia-chuang, and in Szechwan were also started in the First Five-Year Plan period and have since been either fully or partially completed and brought into production. In this regard, the Soviet Union and other "brother" countries have given us great help. The Dairen Chemical Plant, the Nanking Yungli Ning Plant, the Chin-hsi Chemical Plant, and other formerly existing enterprises have also undergone great expansion so that they have also become part of our country's important chemical base. Parallel with the development in production and construction has been the progress in technology and technical manpower. Between 1949 and 1957, technical personnel in chemical engineering was raised 3.4 times. The great accomplishments in the First Five-Year Plan period has created favorable conditions for the further advance of the chemical industry.

In 1958 and 1959, under the Party's socialist construction main line of striving for the utmost and working according to the concept of "more, fast, good, and economical," the chemical industry has made significant strides. In these two years investments by the country in the chemical industry amounted to twice that made during the First Five-Year Plan period and output of certain important products has been either close to or greater than the increase achieved in the First Five-Year Plan period. During 1958, the total value of output

was 70% greater than that of the previous year and the number of new products was nearly 700 greater than the previous number (1957). The total value of output in 1959 will be another 40% greater than in 1958; and the rate of increase for certain important products will be much greater than the average rates in the First Five-Year Plan period. For 8 types of major chemical products as to goals designated in the Second Five-Year Plan period, we believe that three-caustic soda, soda ash, and antibiotics--will attain their 1962 output objectives three years ahead of schedule. The leap forward in 1958 has created circumstances favoring a leap forward every year from now.

One of the most notable characteristics of the "leap forward" of the chemical industry in 1958 is the close coordination of the chemical industry's large scale enterprises that employ modern methods and small scale enterprises that employ native methods; in both cases, the mass line has been effective. The small native group movement has been very important to the expansion of the chemical industry. The main reason the mass movement could be organized is because the great masses under the stimulus of the main line to carry out the political doctrine of the Party, Central Government, and Comrade Mao Tse-tung in liberating thoughts, overcoming superstitions, dare-to-think and dare-to-do, and walking on two legs have, with a revolutionary spirit of hard work, developed small native groups and small foreign groups. The ingenuity of the masses has overcome the concept that developing chemical industries is something sacred and extremely difficult; the small groups have not asked the central authorities for much money and instead have used their own strength and resources to create many small scale plants within periods of only months. For example, there were few if any chemical plants in areas like Sinkiang, Yunnan, Tsinghai, Inner Mongolia, etc. previously; however, through the effort of the masses, many small scale chemical plants have since been built. Many chemical plants have also been established in farm villages, special districts, hsiens, and people's communes; thus, a new avenue of development has been opened for our country's chemical industry.

Results have proven that by relying on the masses to develop chemical industries it is possible not only to establish many plants but also possible to make them operate them well. For example, a chemical plant has been built in Shang-ch'iu Hsien, Honan Province to use local nitrate soil to produce phosphorus potassium fertilizers; results have been very good so that the people involved are very enthusiastic. They went one step further in more fully utilizing the nitrate soil and have made products like potassium nitrate, potassium chloride, magnesium chloride, nitrate salts, hydrochloric acid, etc. This plant did not have a single technically trained man, but with diligent research the workers finally were able to make pure potassium nitrate of 99.94% purity. In Ta-yi Hsien, Szechwan Province, ten small

chemical plants were developed in a few months which successfully made on a trial basis about 48 kinds of chemical products, including calcium magnesium phosphate fertilizer, sulfuric acid, soda ash, acetic acid, glucose, and others totaling 24 products which have already been brought into normal production; it is believed that within this year the entire investments for these 10 plants can be recovered. There are many other examples like Shang-ch'iu and Ta-yi. Many of the small native group type of chemical plants have been reorganized and consolidated into more efficient operations; they should serve as a source of inspiration for other small plants to be built.

The movement for developing many small native group plants was born in conjunction with the great leap forward in agricultural production and the effort to have all the people develop industries. Conversely, as a result of building many small chemical plants, the progress in agriculture and local industries has also been expidited. Last year, the native type chemical fertilizers and the native type insecticides were important in meeting the needs at the time; and native type acids and bases also met parts of the local requirements. The sulfuric acid made by native methods in Hupeh Province have been primarily used in making chemical fertilizers. The sulfuric acid made by native methods at Yung-ch'ing, Fukien Province, has been used to extract metals. The sulfuric acid made by native methods in Sinkiang Province has been used to refine petroleum. In many places native type sulfuric acid has been used to charge batteries to assure steady driving of cars. At the present time, sulfur produced in our country amounts to several hundred thousand metric tons per year, all extracted by native methods. Sulfur is used widely in pharmaceuticals, rubber, "agricultural medicines," light industries, etc. Potassium nitrate is an important chemical product used in defense, "extreme" and many other industries; it is also exported in great quantities to help brother countries. This type of important product is also entirely made by native methods. The hydrochloric acid required by medium and small cities in Liaoning Province is also supplied primarily by native type plants. The electrolytic caustic soda produced in Chun-yi, Kweichow Province, has met local soap production needs. The chemical fertilizers produced by native methods in the country during the first half of the year was about 3,000,000 metric tons according to incomplete statistics for 16 provinces. Also, in the first half of this year, much chemical raw materials, such as sulfuric acid, soda ash, caustic soda, nitric and hydrochloric acids, etc., have been furnished by small-scale chemical plants. Under the present circumstances of inadequate supply of chemical raw materials, output by small plants using native, modern, or combined native-modern methods has been important in supplementing production by medium and large scale plants in meeting over-all needs, particularly the needs of agriculture and local industries.

By spreading the small native groups, much chemical personnel has been trained. Workers with preliminary knowledge of the chemical industry have been trained in all areas where small plants have been developed. During the last year, the technical personnel trained in small plants totaled more than 32,000 according to incomplete statistics; this figure does not include the people dispatched for training in other areas. This technical force should be very important in the rapid future development of the chemical industry.

Experience in a little more than a year shows that as long as the sacred concept of the chemical industry is overcome and the dare-to-think and dare-to-do attitude is encouraged, almost all chemical products can be made by either the small native groups or the small modern groups; the technically-difficult-to-make products like synthetic ammonia and organic chemicals are not exceptions. For example, products like sulfuric acid, hydrochloric acid, caustic soda, soda ash, synthetic ammonia (fixation), phosphate and potassium fertilizers, alcohol, carbide, synthetic rubber, organic silica, furfural, styrene, vinyls, etc., can be produced by small native groups and small modern groups. Of course, when we say that we want to promote the development of small native groups we do not mean that the smaller or the cruder the better. Some products can be made very satisfactorily by small native groups and others (such as synthetic ammonia) by small modern groups; likewise, some products are suitable for manufacture by small scale plants and others by medium scale plants. To summarize, according to circumstances for individual products and following the concept of taking advantage of local conditions, we should carry out a coordinated policy of establishing large, medium, and small scale plants.

2. Oppose Rightists and Arouse Diligence to Fulfill And Surpass the Chemical Industry's Production and Capital Construction Tasks

Pages 9-14 (excerpts) Editorial Department

On the foundation of the great leap forward of 1958, the chemical industry's production and construction have continued to move forward rapidly during the first eight months of 1959.

Output of major chemical products as of the first eight months of 1959 has shown relatively large increases over the quantities produced during the similar period of 1958. For example, sulfuric acid rose 21.1%; soda ash, 32.7%; caustic soda, 28.8%; concentrated nitric acid, 20.7%; ammonium nitrate, 56.8%; synthetic ammonia, 19.2%; and antibiotics, 182%. Production also increased in other important chemical products.

With regard to basic construction during the first eight months of 1959, production capacity has risen greatly for products like synthetic ammonia, ammonium nitrate, dilute nitric acid, sulfuric acid, caustic soda, carbide, polyvinyl chloride and others.

Much progress has also been made in expanding small native groups and small modern groups. Because the small plants are widely scattered over the country, it has not yet been possible to find a way of obtaining good overall statistics. However, according to preliminary data reported by various provinces, the output is impressive.

Generally speaking for all of the provinces, the technical barrier for making contact sulfuric acid on a small scale has been overcome; some of the plants after becoming stabilized are moving towards high production. For example, the small contact process sulfuric acid plant belonging to the Wu-hsi Oil Refining Plant has attained the daily production level of 1,500 kilograms, greater than the designed capacity and at relatively low costs.

The technical barrier for making soda ash on a small scale has also been overcome by some plants. The small soda ash plant of the Ch'in-wang-tao Yao-hua Glass Plant is doing well after making some adjustments. The Ministry has decided to hold a on-the-spot meeting at this plant.

Operating conditions for a synthetic ammonia pilot plant belonging to the Dairen Chemical Plant are very good. Workers there have confidence that they can build regular small scale synthetic ammonia plants. Generally speaking, all these developments were founded on the basis of the great leap forward of last year; a continued leap forward is in progress this year.

During the last eight months much work has been done in both production and construction, and therefore much experience has been gained. With regard to production: (1) Based upon the conclusions drawn from the great leap forward of last year when much experience was gained in the mass movement, we strengthened production management work, straightened out operating schedules, and carried one step further the policy of coordinating centralized leadership and further promoting the mass movement. In this manner, management of enterprises has been raised to a more efficient level. (2) Promoted the mass type of technical improvement and technical revolution to raise the over-all technical level of the staff and workers, greatly developed the production potential, and raised the efficiency of equipment utilization. For example, at the Tientsin Chemical Plant, production of chlorinated benzene has been changed from intermittent operations to continuous operations with the result that output of chlorinated benzene has been raised four times. At the Shanghai Organic Company, through simplifying the flowsheet (from 11 stages to 3) for making sulfurated "deep blue" dye, productivity has been raised ten times. (3) Large quantities of raw materials have been saved through carrying out the policy of "four uses." For example, at the Hsin-hua Explosives Plant, the substitution of dry alcohol for acetone in making "Hai-ch'un-sheng" (means sea, group, and born) has been successful on an experimental scale. At the Northeast Explosives Plant, sulfanilamide made directly by synthesis of lime and nitrogen to substitute for thio-carbamide has been successful on an experimental scale. At the Nanking Chemical Company and others, selenium and germanium have been recovered from sulfuric acid waste slimes. At the North China Explosives Plant, Vitamin B_{12}, etc., has been recovered from waste solutions of aureomycin, etc. Much has also been accomplished in saving, water, electricity, steam, etc. (4) Maintenance and inspection work on equipment has also been strengthened. As of the present, principal equipment of most plants are periodically inspected and maintenance work is generally emphasized. Results have proven that the most important aspect of maintenance and inspection work is steady surveillance and maintenance. For example, at the Dairen Chemical Plant, the No. 1 "K'ung" crew has continuously maintained good-quality low-cost high production; its success lies in good maintenance of mechanical equipment. (5) Technical management and inspection on finished and semi-finished products was strengthened and product quality was improved. For example, the quality of rubber has been raised to the extent that they can be used for 50,000 kilometers, and the crystal recovery rates and the percentage of finished items meeting specifications for aureomycin, etc. have also been increased. (6) Actual experience tells us that transport and storage of chemical products are of great importance. As production develops, we should solve the problems of transport and storage accordingly. Transport equipment for short hauls should be particularly looked into. Storage tanks, tank cars, locomotives, cars, etc., must be increased

and better rotated; these should serve the distribution of products as well as the supply of packaging materials.

With regard to basic construction, the experiences on carrying out projects and accelerating development are as follows: (1) Major projects must be decided on as soon as possible. For example, plans for the soda ash units of the Yung-li "Ku" Plant and the Dairen Chemical Plant, and the synthetic ammonia unit of the Szechwan Chemical Plant were decided on early in the year. Suitable arrangements were subsequently made so that the two soda ash plants will be completed by the end of the year and the synthetic ammonia plant will be brought into production in the last ten days of September. (2) Centralized use and conforming into sets of supplies and equipment will enable great acceleration of construction and improved effectiveness of investments. Take the example of the two caustic soda units belonging to the Chu-chou Chemical Plant and the Ch'u-chou Chemical Plant. Construction was slow at the start of the year. By the beginning of the second quarter, it was decided to construct in stages; funds and materials were centralized for completing the work on the first stage so that the first units of the two plants can be brought into production by October. Another example in the Peiping Chemical Pilot Plant, which, by pulling together manpower, equipment, and other resources, and by making changes and additions, is expected to enter production by September. (3) Tighten up the "wind-up" work, which requires relatively little equipment and supplies but is vital in bringing plants into production. This type of work has been done very well in Kiangsu and Chekiang provinces. For 14 projects in Kiangsu, eight can be brought into production by September and the new output capacity created for caustic soda is 5,550 metric tons /per annum/. Of five projects in Chekiang, two will be brought into production in September, and the rest at the end of the year. The newly created capacities will be 10,000 tons of sulfuric acid, 500 tons of caustic soda and 300 tons of agricultural insecticides. We hope that the various provinces and cities will report to the Ministry the projects brought into operations as they occur. (4) Practiced mutual help. For example, the Lanchow Chemical Plant pulled out welding workers and the Dairen Chemical Plant pulled out soldering workers to help the Szechwan Chemical Plant. The Szechwan Chemical Plant dismantled three already installed oxidized nitrogen blowers to help the Kirin Chemical Plant. The Kirin Chemical Plant pulled out 100 water pumps, 17 acid pumps, 15 electric welding machines, and 12 motors to help construct other units. Similarly, the Harbin Chemical Main Plant pulled out sulfuric acid blowers, and the Hsiangshan Pyrite Mine diverted 700 meters of belt to help others.

As for small native groups and small modern groups, the following points should be emphasized: (1) To enable small native groups and small modern groups to overcome technical barriers, it is

necessary to tightly control test work in terms of good model practices; temporary difficulties should not cause despair. Results prove that technical barriers for small operation can be surmounted. (2) With regard to the economics of small native groups, it should be pointed out that while production costs are relatively high, construction, transport, and packaging charges are low. If the sulfuric acid needed in Yunnan Province were shipped from Nanking, the cost would be about 1,000 yuan per metric ton. Thus, to use local materials in the erection of small scale sulfuric acid plants and to produce for local markets is entirely rational from an economic viewpoint. At the same time, production costs for small plants are steadily being reduced. As a result of technical and management improvements, operating conditions for many small plants are changing from the abnormal to the normal (systematic) with great cost reduction. In addition, there are also political considerations. (3) In order to develop small native groups and small modern groups, it is necessary to have determination and good organization. Anhwei Province has done very well in organizing a chemical-fertilizer directing corps to prepare for the erection of 100 small synthetic ammonia plants. The Ministry decided to help as much as possible, and intends to use Anhwei Province as the model to push the building of small synthetic ammonia plants.

Generally speaking, one should have unyielding confidence in small native groups and small modern groups.

However, eight months or two-thirds of the year have already gone by and production accomplishments are still not good enough, whether looking from the first or second set of estimates. The degree of completion for basic construction, in terms of investments or projects brought into production, is still a little behind schedule.

With regard to production: (1) During the early part of the year, because of the changing supply situation, the operational relationships were not quite clarified and the material and capital distribution was not entirely satisfactory. (2) Transport lagged and the supply of coal and chemical minerals was not normal enough; the power supply in the northeast and other areas was also inadequate during the first quarter. (3) Within the enterprises, the production conditions for water, electricity, and steam, and the supply of certain equipment were not balanced. (4) Equipment inspection and maintenance was not good enough and the manufacture of spare parts did not catch up with the needs. (5) For some organic products such as paints and dyes, the supply of oils and fats, resin, glycerol, alcohol, nitric acid, etc., was not adequate or not balanced.

The fighting objectives for the masses are clear--increase production, make savings (cut costs), and coordinate economic and technical

measures. For example, the Yungli "Ku" Plant, in order to fulfill or surpass the production goal of 300,000 metric tons of soda ash, organized a "300,000-ton soda ash technical measure office" to carry out 25 measures and mobilize the entire working force. In the case of the machinery repair workshop, the work was to strengthen the weak phases; and in the case of the heavy soda unit, the work was to keep the machinery running and cut down on repair time, etc.

According to incomplete records for January to August inclusive, the enterprises directly under the Ministry of Chemical Industry manufactured a total of about 25,000 metric tons of mechanical equipment. Aside from making ordinary equipment, specific amounts of high and medium pressure equipment (containers), acid resistant equipment, and common equipment urgently needed by the chemical industry such as blowers, various pumps, filters, and centrifugal equipment were also made. The local chemical industries also completed their assignments in making equipment and doing additional work on equipment to make them usable.

3. National Holiday Celebration Success Briefs

Pages 15-16 (excerpts) Unsigned article

The Szechwan Chemical Plant is Expected to Produce Sulfuric Acid and Synthetic Ammonia Ahead of Schedule

The workers and staff of the Szechwan Chemical Plant, after overcoming rightist conservatism and through particularly hard work, are very enthusiastic about the prospects for raising production and cutting expenses. During the first ten days of September, the basic construction work completed amounted to 543,000 yuan, or nearly eight times greater than that completed in the first ten days of August and equivalent to all of the work planned for the whole month of August. The dates for bringing the synthetic ammonia and sulfuric acid units into production have been moved forward several times. According to initial plans, the synthetic ammonia unit was scheduled to go through the trial run on 1 October and the sulfuric acid unit was scheduled to be brought into production by 15 October. Actually, the synthetic ammonia unit was run on a trial basis on 13 September, and work transfer is in progress with the equipment being kept warm. Work on the sulfuric acid and ammonium sulfate units has reached the winding up stage in preparation for the trial runs. The conditions for making trial runs seem normal, and it is expected that the first batch of synthetic ammonia will be produced by 28 September and the first batch of sulfuric acid, possibly by 1 October.

New Records for Making Caustic Soda Established by the Tientsin Chemical Plant

The staff and workers of the Tientsin Chemical Plant, on the foundation of surpassing August objectives by 3.6%, have tightened the production work in early September with the hope of establishing new records. During the second ten days of September, despite very unfavorable conditions brought about by low-pressure electricity from outside, the staff and workers through various means in overcoming difficulties have made sure of the attainment of higher output goals with regard to caustic soda, agricultural medicines and plastics. The cadres and supervisors of the plant went deeply into the production front to organize united action by four different units and tightened the implementation of technical measures. The "Lieh-wen" evaporation tanks were successfully brought into operations by the 15th, and the newly added five "Hu-Ko" electrolysis cells were also brought into normal production by the 17th. For more efficient utilization of the rectifiers, the angle of connecting lines was improved and the amperage of the current was raised by 1,600 amperes with the result that daily caustic soda production was raised more than 4 metric tons. Thus, the operational objectives for the second ten days of September were overfulfilled and output in this period was 26% greater than the similar period in August.

On 20 September the Party representative of this plant proclaimed the new fighting slogan "battle the next ten days for higher production" to stimulate the enthusiasm of the masses. As a result, the new daily records for the plant--127 metric tons of caustic soda and 15.8 tons of polyvinyl chloride-- were established. On the basis of these accomplishments, the staff and workers are determined to surpass the third quarter quotas ahead of schedule.

<u>The Dairen Chemical Plant Increases Daily Output of Ammonium Carbonate And Achieves September Quota 19 Days Ahead of Schedule</u>

The small group of staff and workers engaged in making ammonium carbonate at the Dairen Chemical Plant, to welcome the national holiday, achieved the September quota of output 19 days ahead of schedule.

This crew, inspired by the Party's proclamations at the Eighth Plenary Session, overcame all kinds of difficulties. When inadequate water affected cooling and hence production, the crew, after repeated investigations, adopted the measure to increase pumps and utilize waste water for cooling. As a result, the efficiency of cooling was raised 1.5 times and daily output of ammonium carbonate was raised 1.4 times; in this manner, the September quota was achieved ahead of schedule. By the end of September, the crew expects to produce 200 metric tons more than what was originally planned.

4. Brilliant Achievements in Chemical Technology During The Past Decade

Pages 18-26 (excerpts) Li Su

During 1958, under the Party's main line of socialist construction according to the concept of "striving for the utmost and 'more, fast, good, and economical'" and stirring the masses to greater efforts, a new situation of production leap forward on all fronts was created in industry and agriculture. The progress of the chemical industry was no different. As a result of thought liberation among the staff and workers and an attitude of dare-to-think and dare-to-do, many new chemical products were produced and many new techniques were adopted. Because of delegation of authority to individual units, a good foundation for the development of the chemical industry was established. Organization of people's communes liberated the production potential, which meant greater agricultural output as well as the establishment of "thousands to tens of thousands" of medium and small scale chemical plants that employ either native or native-modern combination methods of operations. These plants built on the basis of meeting local needs in various areas incurred great savings in transports and created the necessary momentum to push economic development of various areas. These small plants in utilizing local materials produced many products such as chemical fertilizers, agricultural insecticides, explosives, sulfuric acid, soda ash and others. In this manner, the concept that the chemical industry is sacred was overcome in the minds of the masses. Many people became acquainted with the fundamentals of chemistry and many chemical technicians were trained. These plants are being consolidated and expanded, and should have an important effect on the future progress of the chemical industry. The total output value of the chemical industry in 1958 was 70% greater than in 1957 and 21 times more than in 1949. The 1958 output of basic chemicals showed increases over 1949 as follows: sulfuric acid, 17.5 times; caustic soda, 17.3 times; soda ash, 6.3 times; and chemical fertilizers, 29 times. An organic chemical industry has gradually been established making products like methyl alcohol, formaldehyde, acetic acid, acetone, methyl ethyl carbinol, aniline, phthalic acid, benzoic anhydride, and phloroglucinol. Through the establishment of the organic chemical industry, there followed the production of agricultural insecticides, pharmaceuticals, plastics, dyestuff, paint, and additive materials. Our country is also starting to build a high component chemical industry with products like synthetic rubber and synthetic cellulose. All these developments have created a good foundation for further great advancement of the chemical industry.

Technology is born from actual practice. New China's technology serves production; hence its great progress has followed production. We will now describe the various sectors of the chemical industry in terms of technological development.

A. Acid, Soda, and Other Basic Chemical Industries

Acid and soda are the foundations of the chemical industry, and they constitute the essential raw materials for other products. Prior to the liberation, our country's acid and soda industries were very weak, but much progress has since been made. As of the end of 1958, output of basic chemicals, such as sulfuric acid, soda ash, caustic soda, and other chemicals had already been expanded ten to twenty-fold.

In the last decade, the technical complexion of the sulfuric acid industry has greatly changed. With regard to resource utilization, the design and manufacture of fluosolid reactors have permitted the use of lower grade sulfur materials including certain tailings from flotation. Investigations have been completed with regard to the use of low sulfur dioxide waste gases from refining to make sulfuric acid. Investigations are also in progress in using gypsum, alum, and Glauber's salt for making sulfuric acid. With regard to equipment, experiments are being made on "Hsuan-feng" (rotating wind) roaster; if successful, not only can more concentrated sulfur dioxide be made but the sulfur in the residue can also be reduced (this should be helpful in iron smelting and the extraction of rare elements).

With regard to techniques, we have constructed under the supervision of Soviet specialists, "high purity seven-tower" type sulfuric acid units, whose "production intensity are more than four times greater than that of "old tower" units. Moreover, the facilities can be made with cast iron and ordinary steel materials so that much lead materials can be saved. As for contact sulfuric acid production, the acid washing flow sheet and the water washing flow sheet methods have both been used in our country. In making sulfuric acid, we have utilized many new types of equipment, such as Venturi tubes (or pipes) to lower the temperature and reduce residue and mist, and spiral and concentric tube types of acid coolers and "four section rotating equipment." The use of such equipment enables simplification of flow sheets and strengthening of production. Bubble or foam towers are used for adsorption and elimination of mist. Tests are being made in the changes of sulfur dioxide in roasting, in nonmetallic equipment, and "anti-rotting" materials. Our self-made V_3 type vanadium catalyst and "ring-type" vanadium catalyst are working well in production; we are also making tests on low vanadium and non-vanadium catalysts.

In expanding the production and convenient utilization of sulfuric acid, several thousand small scale tower and catalytic sulfuric acid plants are being built that should have important repercussions on cities and villages.

The principle method employed by the soda ash industry is the ammonia alkali method. Because the technical level of the workers

has been steadily raised, the operational standards are likewise improving. In our country's soda plants the "12-tower one-section carbonic tower operation" and recycling crystallization method have been successfully adopted and have greatly raised the efficiency of equipment utilization. The technical and economic indices for the carbonic acid towers and calcining kilns are much better than those of western countries, and the quality of soda ash made is maintained at 99% grade or better. With regard to equipment, the use of bubble or foam tower to replace the fill type cooling tower greatly raises the efficiency of cooling; through employing the electric steam filter and "bubble" dust particle removal tower, the efficiency of particle removal reaches more than 99%. The hydrotator (or perhaps hydraulic classifier) has been used in removing sand in milk of lime at an efficiency of 99%; this piece of equipment is also being tried in slime deposition, and, if it can be successfully employed would mean great savings in precipitation equipment for soda plants. Different steam furnaces have been tried out in production which have a capacity three times greater than external heating type furnaces, and operating conditions are better.

New soda ash production methods are also being greatly emphasized. The soda ash and ammonium chloride combination production method developed by chemist Ho Teh-pang is being successfully operated on a pilot plant stage and a full scale plant is being planned. The use of Glauber's salt to make soda ash and sulfuric acid has been successfully tried in experimental production. In addition, investigations are being made on the integrated utilization of natural soda and on the use of Glauber's salt to make soda ash by the ammonia alkali method and to make ammonium sulfate.

Much improvement in equipment has been made in our country's production of caustic soda by the electrolysis method. In the first place, we have raised the current density and changed the method of making connections between rectifying and electrolysis equipment with the result that the performance of the equipment has been greatly improved.

With regard to the electrolysis cells, we have improved the mercury electrolysis plates for the mercury electrolysis cells to attain higher efficiency. By changing the bottom of the mercury electrolysis cells from cement to steel, electricity consumption has been reduced, anode salt accumulation problem has been solved, and mercury consumption has been cut down. We also implemented a series of measures to raise the current density of mercury electrolysis operations without raising the voltage very much. The electrolysis cell which seems to have the most advantages and which is being used to a greater extent in our country is the vertical type adsorption diaphram electrolysis cell; we are trying to make further improvements

with regard to the height of the anode and other aspects. In addition, we have also made improvements in the horizontal diaphram cell by changing the shape of the diaphram to wave or step forms to raise production and reduce power consumption.

With regard to liquid soda concentration, we are tying out the relatively high efficiency "Lieh-wen" type evaporator; this piece of equipment is being pushed in our country because it is high in evaporating efficiency, saves steel materials, and does not form soda scums. In controlling hydrogen in electrolysis, we are now using the automatic control method which not only simplifies operations but also assures better safety.

In our country, the soda made by the mercury method is 99.5% grade or better and that made by the diaphram method is as high as 96%.

B. Chemical Fertilizer Industry

With regard to nitrogenous fertilizers, the raw material gas used for synthetic ammonia has consisted not only of water gas made from coke but also large quantities of gas made from inferior grade brown coal and anthracite; the use of these other raw materials has an important effect on savings of coke for utilization by the metallurgical industry. With regard to gas manufacturing facilities, there are not only fixed-bed type water gas and semi-water gas gasifers but also high efficiency fluid coal bed gassifiers. We have made pilot plant tests on using natural gas and coke oven gas as raw material and partially employing the oxidation method to make a nitrogen hydrogen combination gas; if these methods could be used in production, then our country's rich resources of natural gas and rapidly increasing quantities of coke oven gas would be much more effectively utilized. With regard to purifying gases, methods successfully employed in production include the arsenic soda method and the activated carbon method to remove sulfur and the copper ammonium acetate solution method and the copper ammonium carbonate solution method to remove carbon monoxide. The manufacture of synthetic ammonia catalysts has also made new advances and the catalyst utilization coefficiency has attained international standards.

In the field of producing nitric acid and ammonium nitrate, new modern plants have been built with the help of Soviet assistance and workers have mastered the very new operational techniques of the direct method concentrated nitric acid process, the combination concentrated and dilute nitrate process, and the "tower type making particle method" of producing ammonium sulfate. Pilot plant work is also in progress with regard to the full-cycle and semi-cycle methods of producing allantoin.

In the field of phosphate fertilizers, production of ordinary calcium superphosphate has been widely done. New techniques like the "belt" combining method and the "disc form acid spouting" combining method are being experimented on a large scale. As for making "heavy" superphosphate, extensive research in extracting phosphoric acid of better than 45% grade has shown good preliminary results. Aside from the fact that large quantities of heat method phosphate fertilizer (including calcium magnesium phosphate fertilizer and steel slag phosphate fertilizer) are already produced, the heat crystallization method and fusion methods of flucrine-removed phosphate fertilizers have also been tested on a relatively large scale. The recovery and utilization problems for various by-products from fertilizer manufacture, as for example recovery of nickel-iron (might be ferronickel or nickel and iron), basically are already solved.

In the field of potassium fertilizers, aside from extracting potassium chloride from salt lake salts, pilot plant tests are being conducted on producing potassium-nitrogen combination fertilizer and alumina from treating alum with ammonia; experiments have also been started on treating alum by the fluid bed reducing heat decomposition method. Using potassium feldspar as raw material to make potassium calcium mixed fertilizer has been a method that has already been widely applied.

It should be pointed out that the "thousands to tens of thousands" of native style fertilizer plants are effectively assisting the leap forward in agricultural production. Native method blast furnace production of calcium-magnesium phosphate fertilizer, the making of potassium calcium mixed fertilizer, and recovering nitrogen fertilizers and making crude nitrate from gases from various kinds of kilns and furnaces are techniques which several hundreds of thousands of people have already mastered. This kind of "everywhere blossoming new force" is certainly most precious.

C. Heavy Organic Synthetic Industry

The heavy organic synthetic industry is a basic raw material industry of the chemical industry. Prior to the liberation, only a few types of products, as for example the industrial production of alcohol, benzene, etc., were produced, and only in small quantities; the equipment used was mostly in very bad shape. Research work was essentially nonexistent.

After the Liberation, under the correct leadership of the Party and the Government and following large scale economic construction, the organic synthetic industry was also rapidly developed. By 1958 the principal products that could be produced already totaled more than 40 kinds, including carbide, methyl alcohol, acetone, methyl

ethyl carbinol, formaldehyde, acetic acid, etc., comprising a total of 20-odd products that were produced on a relatively large scale. New products include ocytyl alcohol made from propyl alcohol and "position changing" phthalic acid, etc.

The main improvements in the field of techniques are: medium scale production by the fluid bed accelerated oxidation method and the pressurized naphthyl oxidation method of making the phthalic acid anhydride. The constant pressure hydrolysis method of making phenol from benzyl chloride is employed in production. Preliminary results have been obtained from extensive investigations on the fluid bed accelerated oxidation method of using furfural or benzene to make maleic anhydride and the ethylene chlorhydrin hydrolysis method of making ethylene glycol. New techniques in the process of being investigated include the electrolysis method of making maleic acid and furfural alcohol; the direct oxidation method to make ethylene glycol and synthetic glycerol; the making of styrene from butadiene and carbonyl synthesis, etc.

In addition, important results have been obtained in the study of high and low temperature coke tar. With regard to natural gas, work is being done in making organic products from natural gas by the partial oxidation method, and work is also being done by the electric arc and cracking methods to make ethine and concentrate ethine from dilute solutions. Definite progress has also been achieved in separating gases from crude oil.

The small native group plants have also made considerable progress in making "heavy" organic chemical products. Work has extended beyond the stage of the fermentation method to make acetone and production and integrated utilization of methyl ethyl carbinol, glycerol, and furfural. Much progress has also been made in the production of oxalic acid by the dry distillation [of wood materials] and hydrolysis methods.

D. Plastic Industry

Prior to the liberation, our country was only able to produce in two coastal towns small quantities of "ancient type" phenol-aldehyde plastics. In contrast, there are at present 17 provinces or special cities in the country which have established plastic industries. The production of plastics is rising rapidly. In regard to product type, we can now produce phenol-aldehyde resins, ammonia base resins, poly-vinyl chloride, vinyl perchloride, organic glass, nitric acid cellulose, acetic acid cellulose, chain or cycle oxygen resins, organic silica resins, etc. Small quantities of furfural alcohol resins, ion exchange resins, and low pressure polyvinyl are also produced. Scientific research work in plastics is also developing rapidly in widespread

areas; virtually all provinces and special cities have plastic research organizations and the new products investigated include very advanced types such as paraformaldehyde, polycarbonyl ester, etc.

The types of phenol-aldephyde plastics produced in our country are already quite numerous. For example, we can produce the extruded highly insulated and strongly water resistant types, the extruded acid resistant types, and various kinds of spare parts made out of phenol-aldehyde plastics. In general, manufacturing techniques have been greatly improved, and product quality is very good. The paper and cloth type boards, rods, tubes, shafts, valves, and other products all can satisfy the requirements of the insulating material and machinery manufacturing industries. Glass quality and asbestos quality pressed boards have also been successfully made on a trial basis. Certain types of asbestos phenol-aldehyde plastics sections have already been produced on a commercial basis. In addition, products like phenol-aldehyde rubber,"shell-shape" resins, etc., have also either been produced in small quantities or tried up successfully in laboratory tests. In producing plastics, much success has been achieved in saving raw materials and utilizing substitute materials. For example, the use of low-temperature coal tar and formaldehyde to make phenol-aldehyde plastics is something of considerable significance.

We are also mastering production techniques related to ammonia base plastics, urea-aldehyde "bubble" plastics, urea-aldehyde plastic powder, melamine-formaldehyde plastic powder, melamine-allatoin-formaldehyde plastic powder, urea-formaldehyde glass cellulose compressed boards, etc.

Production of polyvinyl chloride plastics has been greatly developed; the method of production is to first combine ethine with hydrogen chloride and then subject the mixture to suspension flotation. In order to meet the needs of polyvinyl chloride "multiple-opening" plastics and polyvinyl chloride paste products, we carried out intermediate investigations on the "milk solution continuous polymerization" method and obtained good grade resins.

The polymerization of polyvinyl benzene plastics is done by the suspension method. We are making polyvinyl benzene "bubble" plastics on a trial basis. To make strong polyvinyl benzene, we are studying the combined polymerization of styrene and other substances as well as the polymerization of styrene with p-chloro styrene.

Small quantities of low-pressure method polyvinyls are now being produced. Some preliminary results have been obtained in research on the medium-pressure method. Much research work is also in progress with regard to the high-pressure method.

Organic glass is now being produced on a normal basis.

Among the organic silica products, many kinds of insulated lacquer (paints), silica oils, silica rubber, moisture-proof coating materials, and others are being produced in small quantities. Successful manufacture on a trial basis of organic silica high-temperature anti-moisture insulating paints has been accomplished with satisfactory technical standards. Studies are being conducted on more effective organic silica chemical compounds.

We have mastered the production techniques of the multi-use rubber chain or cycle oxygen resins, and are investigating other resins of this category, "changing characteristics" resins, hardening agents, etc.

Ion exchange resins of many hundred types have been made on a trial basis. Extensive research is also being done on electron exchange resins, ion exchange diaphrams, phosphoric acid exchange resins, etc. Some products are already produced in small quantities.

Whether it be in terms of output, quality, or technical standard, our country's plastics industry is developing very rapidly.

E. Synthetic Rubber Industry

After the Liberation, we started to enter this field in which there was no previous production. Chlor-prene-rubber plants have begun to produce. Product quality has reached Soviet standards, but operations are not normalized as yet; the problem of maintaining stability in quality during transit still needs further study.

With the help of the Soviet Union, new butyl benzene and butyl nitrile synthetic rubber plants are being built at a rapid pace and will be brought into production in the near future. For butyl sodium synthetic rubber plants of small scale, the technical and economic barriers have already been overcome. Many more of these plants can be built after operational procedures are stabilized.

With regard to testing and research, laboratory work has been completed for low temperature polymerized and "oil-added butyl benzene" synthetic rubber. Among other new types of synthetic rubber being experimented on are many types such as the propyl ethelene synthetic rubber, the organic silica synthetic rubber, the butyl furfuryl synthetic rubber, and the butyl pyridine synthetic rubber.

Research on "chieh-chih" (connected branch) synthetic rubber is also in progress. For example, the methyl methacrylate, styrene, and acrylonitrile types; chaining of styrene with natural rubber latex is

also being studied. Preliminary results have been achieved in all these techniques.

To adjust to the economic needs of the country, we are paying particular attention to the development of the synthetic rubber industry.

F. Chemical Cellulose Industry

Prior to the Liberation, there were only two such plants which were severely damaged when turned over. One was the unfinished Shanghai An-lo artificial cellulose experimental plant and the other, the Japanese controlled Liaoning An-tung Chemical Cellulose (Fiber) plant. Thus, New China's chemical cellulose industry was almost built from nothing.

After the Liberation, aside from rehabilitating and modifying the An-lo experimental plant and the production of "sticky glue" short cellulose at the An-tung chemical cellulose plant, we have built a "sticky glue" long cellulose plant, an artificial cellulose (fiber) plant, and a "K'a-p'u-lung" and thread drawing plant.

The development of the chemical cellulose industry not only can meet the needs of making wearing apparel but also, more important, because of the varied types with special characteristics, can meet the special needs of industry. This explains why research work in chemical cellulose has been developed at a rapid pace. We are making a special effort in studying the improvement of production procedures with regard to artificial cellulose (fiber), utilization of new raw materials, the making of high intensity "sticky glue" window wire, etc. For example, in the field of artificial fiber, studies are being conducted with regard to tri-acetate cellulose and concrete results have been obtained in solving the technical problems of making "sticky glue" cellulose from banana residue, etc. As for synthetic cellulose, aside from making "ka-p'u-lung" unit bodies by the phenol method, other methods (like the nitroso method which uses chain hexane as raw material) to make "wu-nei-hsien-an" /hexyl-internal-?-amine/ have been studied to the extent of medium scale experiments; "intermediate" studies are also being conducted in Nylon 66 (phenol method), Nylon 11, "T'iao-lun," and vinyl perchloride cellulose; similar studies are planned for Nylon 66 (by the furfural method), Nylon 9, "T'eh-li-lun," polyacrylonitrile, etc. Other principal products being produced or investigated by foreign countries are almost all being studied in our country, too. For instance, definite results have been achieved in research on the new product polyformaldehyde.

In summary, the chemical cellulose industry of New China is on the brink of a great growth and should rapidly achieve outstanding results and fulfill various needs of the economy.

G. Dyestuff Industry

Prior to the Liberation, our country's dyestuff industry was only represented by some small and simple plants located in several cities along the coast. These plants used imported intermediate products to produce small quantities of sulfur dyes and direct dyes.

After the Liberation, the original plants were rapidly modified and expanded and self-supplying of raw materials was stressed. With the help of the Soviet Union, the Kirin Dyestuff Plant and the T'ai-yuan Chemical Plant were established and became important in pushing the rapid development of our country's dyestuff industry. At the present time, the intermediate dyestuff products can substantially be supplied domestically. Thus, the long standing situation of dependence on imports has been changed once and for all.

The types of sulfur and direct dyestuff products produced has been increased greatly. We are able to produce all the main products in acidic dyestuff, basic dyestuff, and coloring materials. Some "high level ice dyestuffs," such as naphthol AS, AS-D, AS-BO, AS-BS, etc., are also produced. With regard to colored base salts, several tens of types of products have been brought into production, including "An-an" blue and a "Hsing-hung" (ape-red) base salt.

Many types of reducing dyestuffs have also been brought into production. The much-liked "Yang-tan-ssu-lin" is now being produced.

Activated dyestuffs were successfully made on a trial basis in 1958; quite a few types are now being produced, including yellow, orange, and red dyes whose quality has reached relatively high standards. Because this type of dyes can be combined with cellulose, the coloring is fast, refreshing, and therefore much desired by consumers.

We are beginning to master the technique and are producing small quantities of paints and print coloring fluids.

Many types of high quality sunshine-resisting direct dyes, acid-metallic combination dyes, copper salt dyes, and phthalein dyes have also been brought into production. We are also carrying out extensive research on dispersion type dyes and new salt base dyes.

In addition, the red, yellow, blue, and other types of color forming agents for colored film have also been successfully made on a trial basis and are about to be produced on a regular basis. Many types of agents for increasing sensitivity and reducing "muddy" (unclear) effect have been successfully tried out and some are being produced.

H. Inorganic Salt Industry

Our country's land area and resources are great, but there was hardly any inorganic salt industry before the Liberation. The industry was essentially developed after the Liberation.

Only since the Liberation has it been possible to determine reserves of the major minerals with a basic degree of accuracy. Technical conditions had to be developed on a planned basis for all the inorganic salts including sodium, potassium, magnesium, barium, aluminum, fluorine, phosphorous, boron, chromium, sulfur, arsenic, and others.

At the present time, the types of products produced is more than seven times that in 1949. We have started to produce products like sodium bichromate, boron materials, fluorine materials (fluorides), perchlorates, metallic sodium, metallic calcium, bromine, iodine, and some rare elements such as lithium, strontium, thorium, etc. Product quality is steadily raised, and some have reached international levels. For example, the calcium content of barium chloride has been reduced to below 0.02% (British first grade product standards contain 0.035% calcium), and the purity of tin dioxide exceeds 99.5%. Good results have also been achieved in the integrated utilization of potassium feldspar, barite, salts, and boron sand waste materials.

Our country's inorganic salt industry has made great advances in quantity of production, technical levels, and product type and quality, but to meet future needs much effort must still be placed in many phases.

I. Chemical Testing Agents Industry

There was hardly any chemical testing agents industry prior to the Liberation. Only a few ordinary simple products were produced, the predominant portion of the needs being met by imports.

After the Liberation, as a result of rapid advances in industry and agriculture, pharmaceutical manufacture, and scientific research in general, production of chemical testing agents became greatly emphasized by the Party and the Government. The total value of chemical testing agents produced in 1958 was more than 100 times that of the pre-liberation period; products now made on an experimental scale total more than 3,000 types and those in normal production exceed 1,500. We have started to produce complex indicators, spectrum purity testing agents (impurity content less than one part in 10,000), and many types of testing agents for super purity materials (impurity content less than one part in 10,000,000). Development of these testing agents will give great assurance to the progress of technology in our country, particularly in the "extreme" sciences.

Following the general development of the chemical testing agents industry, the facilities and production methods for the industry have been likewise improved. For example, the following methods have been employed with good results; ion exchange method, the "lo-ho" method for making high purity products, spectrum analysis, etc. Our country's young chemical testing agents industry is in a period of steady growth.

J. Rubber Industry

The production level of old China's rubber industry was very low. The main products made consisted of some ordinary daily use rubber items and tires, and industrial products of low quality.

After the Liberation, we modified the old plants and built many new plants. To satisfy expanding industrial needs, we paid particular attention to tires and various industrial products. The 1958 output of tires and tubes was 64 times that of 1949. We are making many products which previously could not be made, such as diesel vehicle tires, airplane tires, rubber parts related to cars and airplanes, and other industrial rubber products.

Specifications for tires now total more than 100. We are making on a trial basis many new types of tires used in the international markets. Preliminary trial manufacture of "steel wire window cloth" tires has been successful; these tires are not only strong and mean savings in rubber but are also long lasting. We are producing small quantities of large diameter (1.7 meter) tires. We have succeeded on a trial basis in making "no inner tube" tires. We are also doing research on natural rubber latex tires and "no window wire" tires.

We are producing strong conveying belts, "cut-type" loading belts, and long wear transport belts.

We are trying out new products like rubber air springs, rubber oil tanks, and 30-ton rubber oil boats. Large-size (2,000 gram) testing balloons have reached international standards with regard to height of flight.

In the field of production techniques, equipment performance and product quality have been much improved as a result of adopting new techniques. The capacities of the rubber refining machines have been generally increased, their refining time reduced, special agents are added, and some plants are employing continuous processes (for refining, pressing, and forming). The country's "rubber refining capacity" has been about doubled.

K. Pharmaceuticals

Before the Liberation, there were only some processing plants. For example, although small quantities of the sulfanilamides were produced, the raw materials came from abroad. There was no antibiotics industry, such products having been entirely imported. Most other important pharmaceuticals were not made at all.

Since the Liberation, as a result of the Party's concern over the health of the people, a pharmaceutical industry truly serving the needs of the people has been established. Many hundreds of types of "raw material pharmaceuticals" are now being produced, and several hundred other types have been studied enough so that they can be brought into production in the near future. Included in the pharmaceuticals produced or about to be produced are: anesthetics for the central nerve system, pain relieving medicine, heart strengthening medicine (cardinala) for the heart arteries, "anti-feeling coloring medicine" like sulfanilamides, "anti-coagulating" medicine /haparin?7, anti-malaria medicine, hormones, vitamins, anti-cancer medicine, internal medicines like enzymes, ammonia-base acids, stomach medicines, and blood substitute medicines, plus others such as poison relieving medicines, consterpation medicines, cough medicines, and general medicines.

We have established an antibiotics industry since the Liberation; a number of large plants of this kind have been built with Soviet help. Aside from producing large quantities of penicillin, we are also making aureomycin, streptomycin, achromycin and tetracycline. Those antibiotics successfully made on a trial basis and soon to be brought into production include the erthromycin (red color), "tuo-chan-chun-shu" (many sticky fungas), new mycin, and many others. Because our country can now supply many types of antibiotics, many kinds of illnesses can be healed. The use of antibiotics in our country is now extending to the animal and plant fields.

In the sulfanilamide group, large quantities of sulfathiazol, sulfanilamide amidines, and "ammonia benzol" sulfanilamides are being produced. Other "high level" sulfanilamides such as sulfadiazine and sulfanilamide "methyl pyrimidine," etc., are brought into production one after another. All these pharmaceuticals have been made from domestic raw materials; operational standards and product recoveries have reached international levels.

Ovarian hormones were not produced before 1958. Now we can make progesterone, propionic acid "testosterone," methyl testosterone, etc. Successful on a preliminary investigation basis are products like "p'i-chih" (leather quality) ketone. Synthesis of the hormone medicines is based upon utilization of local materials such as plants like

"fen-pai-chieh," "ch'uan-ti-lung," etc., which are abundant in our country and therefore means that large quantities of hormones can be produced.

L. Chemical Equipment Industry

To accommodate expanding production needs, we have already established a chemical equipment industry. Take for example the field of synthetic ammonia, we have made large size water gas gasifiers, gas freezing equipment, 5,600 horsepower compressors, 320-atmosphere synthesis chambers, and various types of automatic instruments. Because our country can make the entire series of ammonia synthesis equipment, the development of the nitrogenous fertilizer industry will be greatly facilitated. We can also supply certain equipment needed for the plastics, rubber processing, synthetic fiber, and pharmaceutical industries.

In the last ten years a large corps of technicians for the chemical industry has been trained. Aside from the fact that many technicians have been trained for the plants and mines and the technical strength in the field of research and design has been increased, the over-all technical standards are also steadily rising. We now can assume the responsibility of designing nitrogenous fertilizer, acid and alkali, inorganic, rubber, pharmaceutical, and other industrial plants.

In the last ten years, there has not only been much progress in production and techniques in our country's chemical industry but a foundation for more rapid future development has also been established. Because of the previous weak chemical base, we still cannot meet all the needs of the country's economy and must strive to do better. We not only must stress production and construction, but also the advancement of techniques. For example, we must expand our work in acids, alkalies, fertilizers, "agricultural medicines," synthetic rubber, etc. We must make more and better products in the field of organic synthetics such as plastics, dyes, pharmaceuticals, etc. We have just started in inorganic salts and synthetic fibers; many new problems await solution with regard to integrate utilization of coal, petroleum gas, natural gas, agricultural byproducts, sea water, salt lakes, etc. The work ahead for those in the chemical field is great, and we must still go through a very difficult period.

The great successes in 1958 were achieved under the reflection of the main line, the liberation of thought bondage, the basic ingenuity and strength of the people, and the revolutionary spirit of "dare-to-think and dare-to-do." Now the Party's slogan is "fight against rightists, work particularly hard, increase production at lower costs, and attain the main goals of the Second Five-Year Plan in two years." We can understand why we must do more and make 1959 another banner year.

5. Grand Achievements of the Chemical Fertilizer Industry During the Past Decade

Pages 26-27 & 14 (excerpts)

Planning Bureau, Ministry of Chemical Industry

With regard to the refining of raw material gas, our country has already mastered the techniques of sulfur removal by the arsenic soda and activated charcoal /carbon?/ methods. In the arsenic soda sulfur removal units designed in our county, the sulfur removal efficiency reaches about 95%, which is not only much higher than the sulfur removal rate by the original limonite method but also permits the recovery of by-product sulfur having a purity exceeding 99.5%. The activated char-coal method is also very efficient in sulfur removal for it rids the inorganic sulfur in the raw material gas along with the organic sulfur.

Using carbon monoxide to convert catalysts has done away with the phenomenon of surface crusting and raised the conversion efficiency; catalysts contining relatively low magnesium oxide can also be made; the activated characteristics is raised at low temperatures; in general, the conversion capability of the carbon monoxide method is much higher than that for conversion methods employed in the past. Research on iron manganese catalysts also has shown successful preliminary results.

In the field of phosphate fertilizers, our country has mastered the production techniques related to superphosphates and calcium magnesium phosphate fertilizers and has built plants that have since entered production. In line with our country's resource conditions, we have made successful preliminary studies on "heavy" /triple?/ superphosphate, defluorinated phosphate fertilizer, the use of nitric acid in place of sulfuric acid to treat phosphate ores, and the use of nitrogen oxide to treat phosphate ores so as to produce a combination fertilizer containing both nitrogen and phosphorus.

The potassium fertilizer industry is the youngest component of our country's chemical fertilizer industry, and its progress has been great in the last ten years. Preliminary results have been attained in research and intermediate (scale) testing on manufacturing potassium fertilizers from alum by the ammonia soda method and the flash reduction heat decomposition method. Successful experimentation followed by actual production have been accomplished in making potassium-calcium fertilizer through adding gypsum and lime to potassium feldspar and in making potassium fertilizer through adding salt (or Glauber's salt) and limestone to potassium feldspar. Meanwhile, a plant for extracting potassium fertilizers from the carnallite of salt lakes has been established and partially brought into production.

"Minute quantity element (al)" fertilizer is a new type of fertilizer. Our country has successfully made it on a trial scale. In fact, many types of fertilizer of this group can be made.

In the chemical fertilizer industry, the manufacture of necessary equipment is a basic problem in further development. Specifications and technical requirements for various types of large equipment are very rigid, particularly for the synthetic ammonia industry. The equipment must be resistant to high temperature-high pressure conditions, to low temperature-low pressure conditions, to acids, to alkalies, etc.

Great accomplishments have been achieved in the field of chemical equipment in the last decade. We have successfully made on a trial basis large size vacuum equipment, large size high pressure air compressors, and high pressure synthesis chambers. In fact, we can now make all the equipment needed for building synthetic ammonia plants. These developments should greatly accelerate further progress in our country's chemical fertilizer industry.

6. Developments in the Sulfuric Acid Industry During the Last Ten Years

Pages 28-30 (excerpts)

Planning Bureau, Ministry of Chemical Industry

The year 1958 was a great leap forward year in our country. The sulfuric acid industry was progressing along the lines suggested by the Party's policy of walking on two legs. Small and large sulfuric acid plants were simultaneously built at an accelerated pace. In line with our country's conditions and needs, many small tower type and contact type sulfuric acid plants have been or are being built in many parts of the country, starting from the latter half of 1958. Data from these small plants show that the conversion rate of catalysts reaches about 85-95%, and the concentration of the products made is generally about 90% and sometimes as high as 98%; the impurities in the acid from small plants are higher than those in large plants, but the product is suitable for general use. When the climate is relatively dry, some plants can even make "smoking" sulfuric acid having a concentration of 104%. These small plants can be built very quickly (only half a month), and the investments and steel materials needed per unit ton of product are much lower than those necessary for large plants. Widely scattered raw materials can be used. Sulfuric acid production by small plants satisfies the urgent but relatively small needs of medium and small scale industrial plants in various parts of the country and helps promote general industrial and agricultural production. More important is the fact that the masses have learned that the chemical industry is not "sacred." As a result, a large corps of technicians with different levels of qualifications but with much practical experience have been trained and "tempered." These technicians should prove most helpful in constructing the many large and medium scale sulfuric acid plants needed in the future.

At present, the contact sulfuric acid method occupies a very important position in our country's sulfuric acid production. The proportion of output by various methods has changed considerably since old China times. Data in 1959 shows the following percentages in output by method: contact method, 72.6%; tower method, 23.5%; and lead chamber method, 3.9%. With regard to utilization of resources to make acid, we have not only developed much new sulfur resources to change the former condition of dependence on imported sulfur but also have started to utilize waste gases from nonferrous metal smelting and by-product tailings (pyrite concentrates) from flotation to produce sulfuric acid. According to data for 1957 with regard to raw materials used, pyrite represented 72%, flotation tailings 21.8%, smelting waste gases 4.4%, and sulfur 1.8%. The large quantities of useless pyrite cinder are now used for smelting iron, ferrous sulfate, and cement. From the waste acids derived from the electric mist removal equipment,

we are extracting the rare elements selenium and tellurium. Liquid sulfur dioxide of 99.5-99.8% purity is made from high concentration sulfur dioxide gases recovered from the "tail (or end) gas equipment." These operations are now part of the regular production cycle. In the two years 1958 and 1959, we have done much research in the utilization of various sulfur resources to make sulfuric acid. Preliminary results have been achieved in the research work on making sulfuric acid and soda from Glauber's salt (Na_2SO_4). We have made pilot plant tests and have designed a 1,010,000-ton sulfuric acid plant to use a 100% SO_2 gas made from 1-1.5% SO_2 gases recovered from a lead smelter and a copper smelter by the alkali aluminum sulfate liquid absorption method. Preliminary results have also been achieved in research work on the production of sulfuric acid from alum and gypsum.

The vanadium catalyst used for the production of contact process sulfuric acid was traditionally imported until 1952 when it was first produced in our country. The activity characteristics, stability under heat, and the mechanical strength of the vanadium catalyst made in our country are all relatively high as compared with the various types of vanadium catalysts imported in the past, and the SO_2 conversion rate is higher. The chain type vanadium catalyst successfully made on an experimental scale in 1957 is higher in activity characteristics than the column type vanadium catalyst and the resistance is only half as much; the chain type vanadium catalyst is now widely used in producing contact sulfuric acid. In 1958 we successfully made on an experimental scale a low temperature vanadium catalyst which starts to ignite at temperatures about 20°C lower than ordinary catalysts; this type of catalyst permits reduction in surface area of the heat exchanger and is beneficial in controlling the temperature of the converter.

Following the rapid advances in technology, we can now independently design large, medium and small scale tower types and contact type sulfuric acid plants; we can also make all of the equipment. Because a large corps of technicians have been trained in actual operations, we are able generally to construct large scale modern sulfuric acid plants in 7-10 months. In recent years, we have also done a great deal of research in sulfuric acid. Among various problems being investigated, aside from utilization of various sulfur-containing resources, are the following: utilization of waste heat, use of fluosolid reactor in roasting ores, use of dry rotation method and supersonic wave instrument to remove dust in the problem of purification of gases, reactivating and re-use of waste vanadium catalysts, non-vanadium catalysts, fluidized catalysts, etc. Preliminary results have already been obtained with regard to research on the above mentioned problems.

7. <u>Ten Years of Construction Achievements in the Soda Manufacturing Industry</u>

Pages 33-34

Planning Bureau,
Ministry of Chemical Industry

With last year's great leap forward in carrying out the policy of native along with modern; simultaneous large, medium, and small scale; simultaneous central government and local industries; and all the people developing industries, the soda manufacturing industry has made rapid progress, particularly soda industries employing the salt electrolysis method, and almost all provinces are developing caustic soda plants of different sizes. When the construction of all these plants is completed, production of our country's soda manufacturing industry will reach an even higher level. We estimate that if the 1959 plan of output is achieved, production of soda ash shall be about nine times greater than that of 1949 and production of caustic soda 22.6 times greater.

<u>The Soda Ash Industry</u>

1. In the salt solution system, we are employing the multiple bed mud washing barrel in place of compressed mud equipment. Productivity is greatly raised and consumption of crude salt is reduced.

2. Anthracite is used in place of coke to burn the lime. This helps the steel industry, minimizes the problem of making coke, and in general is of great economic significance.

3. Ammonium chloride and soda ash are produced simultaneously. This method has been successful in pilot plant tests, and has been used in designing large plants. By this production method, the salt utilization rate can reach 90-94%, limestone is not used, and the amount of large and cumbersome equipment, such as lime kilns and ammonia distillation facilities, can be greatly reduced.

8. Technical Achievements in the Dyestuff Industry During the Last Ten Years

Pages 35-36

Technical Bureau,
Ministry of Chemical Industry

Our country's dyestuff industry like all other industries was very backward before the Liberation. The supply of dies virtually all came from abroad. Even the small and simple plants located in Shanghai and other areas depended upon imported intermediate or semi-finished products to make four or five different kinds of dyes; the technical level of these plants was obviously very low. Moreover, as a result of maltreatment by imperialists and capitalists, the bulk of these plants became idle just before the Liberation.

After the Liberation, the Party and the Government adopted a series of measures. During the period of rehabilitation, the idle dye plants were all put back into operation. At the same time, for those plants which have relatively favorable conditions, important intermediate dye product units were added to make products like dinitrochlorobenzene, aniline, pheylphenol, etc. Thus, the most important basic raw materials needed by the country's dyestuff industry were produced, and dependence on imports for these materials was no longer necessary. From this time on, our country's dyestuff industry started on the road toward gaining strength from within. By 1952, 35 types of dyestuffs were produced; total output exceeded 20,000 metric tons, greater than before the Liberation.

During the First Five-Year Plan period, with the help of the Soviet Union, we started to develop the Kirin dyestuff base and, at the same time, modified and expanded the originally existing plants. In 1955, under the successful socialist program of joint state-private operations in which the whole dyestuff industry was organized under national planning, an accelerated pace of development in the dyestuff industry became possible. By 1957, whether it be dyestuff product type, total output, or production technique, the industry had already advanced to fairly high levels. About 156 types of products were produced, adequate to satisfy about 80% of the country's needs; we started to produce most of the intermediate products needed; the situation of being totally dependent upon imports for dyes became basically changed.

At the start of the Second Five-Year Plan period, guided by the main line of socialist construction "to work hard, fight for the upstream, and produce according to the concept of 'more, fast, good, and economical'," the great leap forward year of 1958 in which rapid progress took place in all fronts thus came about. The dyestuff industry also advanced at a rapid pace--product type reached 300 and 144 new dyestuff products were added to the list produced within a

year. This kind of advance is without parallel and clearly shows the great progress in the dyestuff industry.

The dye products already produced include the ordinary types of sulfur or sulfide dyes and direct dyes applied to cotton, the acid dyes and the "mei-chieh" dyes applied to wool, the salt-base or alkali nature dyes applied to paper, colors used in paints and printing ink, and colors used in food products. In addition, the high quality "ice dyes" used in printing that entirely came from abroad in the past are now predominantly supplied within the country. We are also producing many types of very fast reduction dyes, strongly sunshine resistant direct copper salt dyes, and resistant-to-washing types of strong acid, weak acid, or neutral metallic combined dyes. We also produced in 1958 many types of very new dyes (such as activated dyes) which have only recently appeared in world markets. We have mastered the techniques on a preliminary basis and have produced in small quantities dyestuff materials such as certain paints and printing fluids, phthalein dyes, and other new types of combination dyes.

With regard to the production of intermediate products, product type and volume of output have been greatly increased and advanced techniques have been adopted. For example, in the production of aniline, the continuous method has been substituted for the intermittent method; in the production of 2,3-acid, the solvent method is now used. Adoption of these and other new techniques not only has greatly raised the production capacity and efficiency but also has improved product quality.

The dyestuffs produced in our country, aside from supplying domestic needs, have also been partly exported. During 1958, exports were made to 18 countries and areas; our dyes have established a good reputation in Southeast Asia and Africa; the scope of trading has even been extended to Europe. More than 100 types of dyestuffs were exported in 1958, including large quantities of sulfur and direct dyes and some "ice dyes," salt base dyes, indanthren dyes, and intermediate dyestuffs. Within a few short years, our country has been changed from one entirely dependent on imports to one which exports some high quality dyes. The world seems very surprised.

We should mention in particular that under the Party's socialist construction line and its slogan to "liberate thought and overcome superstition," our country's workers in the dyestuff industry have developed the communist tradition of "dare-to-think, dare-to-do, and dare-to-speak" and, as a consequence, have successfully made on a trial basis many new types of dyes during 1958. For example, activated dyes, special paints, and printing fluids among the new products made without literature but with great daring. Meanwhile, the sacred concept toward research has been dispelled in the minds of ordinary

workers, and large numbers of technicians entered ih the field of research on new products.

These achievements show that our country's dyestuff industry has attained relatively high levels and is striving to catch up with the world's advanced countries. They also prove that the Chinese people when given a chance to overthrow reactionary control and under the direction of the Party to "liberate thought and dare-to-think and dare-to-do" can achieve outstanding records.

These accomplishments cannot be separated from the unselfish help given to our country by the Soviet Union. Since the Liberation, the Soviet Union, aside from the help in completing the Kirin Dyestuff Plant, sent more than 20 specialists to direct the production of dyestuffs and intermediate dyestuff products. We also received much help from the Soviet Union in the way of Chinese technicians being trained in that country; upon their return, these trainees have become the central corps of our dyestuff industry with regard to production, research, and management. In addition, the Soviet Union also furnished us with literature concerning nearly 200 types of dyestuff and intermediate dyestuff products. Our people are extremely grateful for the unselfish help given by the Soviet Union and for the strong friendship developed. We believe that Soviet assistance has played a very important role in the development of the dyestuff industry.

In the field of additive agents, only one type of product--"Turkey red oil"--was produced prior to the Liberation. There has been much development since the Liberation. Our country now has two plants specifically for producing additive agents. The Kirin Dyestuff Plant, our country's dyestuffs base built with the glorious unselfish help of the Soviet Union, is also producing certain additive agent products. We now can produce "pao-hsien fen" (literally, insurance powder), bleaching powder, dispersion agent HØ, color fixing agent DUY, sodium alkyl naphthalene sulfonate, and other products totaling more than forty in number. Of the 56 new products made on a trial basis in 1958, 28 have since been brought into production. In the field of washing and cleaning agents, sodium alkyl sulfonate (petroleum soap) and No. 12 sodium alkyl benzene sulfonate are now being produced. Among emulsifying agents, there is the emulsifier ØM, etc. Other additive agents for printing and dyeing, such as agents for immersing and soaking, even dyeing, selective dyeing, dye prevention, water softening, increasing whiteness, etc., are also being produced. These accomplishments show the rapid advances made in oru additive agents industry, which speak well for possible accelerated developments in the future.

Achievements in the last decade are great. However, for a country of more than 600 million people, the level of accomplishments in our

dyestuff industry is still unable to meet the needs of our country's economic development and the improvements desired for the people's livelihood. We must still rapidly move forward along the socialist construction line of working especially hard to "fight for the upstream."

Our country's dyestuff industry must develop according to the following principal lines in the future:

1. Coordinate dyestuff production with demand, greatly raise the output and diversity of intermediate dyestuff products, adopt new techniques, and improve the present production flowsheets so that our country's dyestuff industry is entirely based upon domestic resources and self-made intermediate products.

2. Produce even more high quality dyestuffs so as to satisfy the growing needs of the people for increasing quantities of diversified quality products.

3. Continue to investigate and develop various new types of dyestuffs. To satisfy the special needs of various industries, it is necessary to work closely with the consumers and systematically expand the production of cellulose dyes (including natural and synthetic cellulose or fibers) and do research on coloring of plastics and rubber, color forming agents for color movie film, agents for increasing sensitivity, general chemical agents, and "extreme" type dyestuffs used for defense purposes.

4. Rapidly expand the production of printing and dyeing additives for textiles. Improve the useability of dyestuffs and raise their quality.

We strongly believe that under the leadership of the Party, on the foundation of the great achievements during the last decade, and by continuing to work hard in developing production through better techniques and savings in cost, our country's dyestuff industry can, within a relatively short period, satisfy the ever-increasing needs of the people for a better cultural and material life.

9. <u>The Glorious Achievements of the Pharmaceutical Industry During the Last Ten Years</u>

Pages 40-42 (excerpts) Lung Tsai-yun

The pharmaceutical industry is making rapid progress. The value of the industry's output in 1957 was 9.7 times that of 1952; the average increase during the First Five-Year Plan period was 58%; the production of "raw material" medicine during 1957 was 16 times greater than that of 1952. For 26 major pharmaceutical products, output in 1958 was twice the 1957 totals. The widely used antibiotics, sulfanilamides, and fever-relieving medicines produced in the first half of 1959 represented 139% the combined totals for the similar period in 1958.

In the past, there were only two plants producing antibiotics; now there are 15. Output of antibiotics in 1957 was 30 times greater than in 1952; production increased rapidly after the large modern plants built with assistance of the Soviet Union were brought into operation; actual output during the first half of 1959 was equivalent to 99% of the total in 1958 and 4.4 times the total in 1957. Penicillin and streptomycin now more than satisfy medical, animal husbandry, egg production and other needs. Other antibiotics like terramycin, tetracycline, erthromycin, etc., will also be produced in large quantities in the near future.

Production of sulfanilamides in 1957 was 28 times greater than in 1952. During the last two years, the main work dealt with trial manufacture of new products and construction of new production bases, including the Taiyuan sulfanilamide "united" plant built with Soviet assistance. There are now nine places producing sulfanilamide drugs. Production during the first half of 1959 was 9.8% greater than in the similar period of 1958 and corresponded to 63% of the total for 1957. At present, our country's total production of sulfanilamide drugs has already exceeded that of the United Kingdom (British output in 1955 was 414 metric tons) and that of the United States (U. S. output in 1957 was 1600 metric tons). After the basic construction work for this year is completed, the productive capacity of facilities in the country will be two and one half times the 1957 output.

We only started to develop the production of fever-relieving medicines at the end of the First Five-Year Plan period. In the last two years production has also been increasing greatly: output in 1958 was 40% greater than in 1957; output in the first six months of 1959 equalled 78% the total for 1958; the number of production units increased from 2 to 8.

As for vitamins, hormones, internal medicines, and other synthetic medicines, many types of products are either beginning to be produced

in large quantities or are being produced on a trial basis. Production of manufactured medicines has been rising rapidly; output of the injection types in 1958 was 8.6 times that of 1952, and tablet type, 8.5 times.

The basic construction work for the pharmaceutical industry has also been outstanding. Investment in 1957 was four times that in 1952, and the combined investment during 1958-59 was 70% the total for the First Five-Year Plan period. Since carrying out the policy of simultaneously emphasizing central and local plants, large and small plants, and native and modern method production, the development of the pharmaceutical industry has become even more rapid. During the last two years, not only has there been much progress in established bases along the coast, but there has also been much construction of medium and small "raw material" plants and units in the interior. For example, the Shanghai pharmaceutical industry's 1958 output value of "raw material medicines" topped 1957 by 27%. In provinces like Shensi, Yunnan, Heilungkiang, Honan, etc., where only manufactured medicines were formerly produced, pharmaceuticals like sulfanilamides and antibiotics are now being produced and much construction is taking place in "raw material medicines" and intermediate product plants and units. At present, each province and city (special city) already has its own pharmaceutical plant. The former situation of facilities being concentrated along coastal regions is gradually being changed. This new development should have a good effect on coordinating the sickness prevention and cure work in various provinces with the utilization of local resources.

Through constantly adopting new techniques in the last few years, much has been achieved in improving operations, simplifying flowsheets, and utilization of better tools or equipment. Since the great leap forward of 1958, by closely following the policy of "political direction, mass line, liberation of thought, cadre system, and close coordination between engineering technicians and workmen," we have, within a year and a half, made large and small changes numbering thousands to tens of thousands covering a wide scope of activities and, as a result, increased recovery, saved on raw materials, raised production, reduced cost, and increased productivity. For example, to produce a ton of sulfathiazole it formerly took 27 tons of principal raw materials and now it takes only 13.5 tons. In the case of phenacetin, as a result of steady improvement in technology and better balance of equipment, the present yearly production is 10 times the designed capacity. The production of achromycin, because of great advances in technology through the years, has been raised five times and the accumulative cost reduction in three years amounted to more than 30 million yuan. In the field of antibiotics, as a result of developing new bacteria and breeding methods, the number of units doing fermentation work has been raised each year: at the Shanghai No. 3 Plant, the average

annual increase in the last five years has been 28%; at the North China Pharmaceutical Plant, output of penicillin in the second quarter of this year was on the average 3.5 times the designed capacity, output of streptomycin has been more than twice that of 1958; and over-all productivity in 1957 was 5.7 times greater than in 1952.

Integrated utilization, conservation of materials, recovery and re-use, and search for substitutes are the thrifty concepts of socialism which have been deeply imbedded in the minds of all people engaged in production. For example, the Shanghai T'ai-shan Chemical Plant in making sassharin has recovered by-product raw materials totaling more than 10 kinds for use in manufacturing anti-rotting agents, communications materials, and color films; the value of the by-products exceeds that of the sassharin. In the production of phenacetin, by-products were made into "mi-t'uo-erh" and "ta-su-ta" (big soda) for use in photography. In the extraction of tetracycline and terramycin, the ion exchange resin is used in place of the organic solvent. What we are doing is just like what Marx had prophesized: "the advances in chemistry teaches us to reproduce and recirculate the waste materials derived from production." The thought-liberated working people in daring to fight against tradition and remove many inequities of the rightist concepts have victoriously treaded on new technological levels.

To meet the needs for assuring rapid increases in production, much work has also been done in building the technical force. Aside from training hundreds to thousands of basic core technicians in actual production operations, many technicians are also trained in academic institutions. At the East China Chemical Engineering University, special departments have been established in antibiotics and chemical pharmaceuticals; in five other pharmaceutical departments, large numbers of chemists, biologists, and other specialists in the field of crude and manufactured pharmaceuticals are also being trained; in addition, medium-level technical schools in these lines have also been established. In 1957, there were a total of 4,000-odd students, about 700 at the East China University. During the last few years, more than 100 special technicians have also been sent to the Soviet Union for academic research and practical training. Old China in 40-odd years time only trained 2,000-odd technicians in this line, including about 850 in five schools in the 16-year span of 1933-49. In comparison, the progress under socialism is "a thousand li in a day." To promote more rapid development in production, we have established many special research agencies dealing with antibiotics, combination medicines, biology, chemistry, product manufacturing, etc. Within many large scale enterprises, central experimental laboratories dealing with research on production techniques have also been established. At present, there are more than 1,500 special research technicians in the field of pharmaceuticals within the country. To smoothly fulfill the responsibilities of basic construction, we have also created

pharmaceutical machinery plants, special crews for installing mechanical and electrical equipment, and a pharmaceutical industry design institute.

The Five-Year Plan points out that "the development of sanitation and medical facilities is an important aspect of improving the peoples' welfare and it is essential to prevent severe illnesses and raise health standards." In the last few years, we have been steadfastly following these directives and closely coordinating the many kinds of work done in the sanitation field, producing large quantities of penicillin, streptomycin, achromycin, sulfanilamides, etc., to fight against contageous diseases; producing various kinds antimony-manufactured medicines to eliminate schistosomiasis and kala azar; producing "yen-shuan-lu-hu" (chloro hydrochloride?) and amine quinine to eliminate malaria; producing tetrachloroethylene, 1-bromo 2-naphthol, and santonin to combat hook worm and tape worm sickness; producing "hai-ch'un-sheng" and "ch'ia-pa-shen" to cure "blood thread worm sickness"; and producing large quantities and many types of vitamins, hormones, and nourishment medicines to meet medical needs and to improve health. With regard to research on medicines used in cancer and high-blood pressure (hypertension), we have also started to do useful work of a pioneering nature.

In the short span of ten years our pharmaceutical industry under the leadership of the party, relying on mass efforts, obtaining the unselfish assistance by the Soviet Union and other "brother countries," and closely coordinating with sanitation and health activities, has "from nothing to something and from small to big" achieved glorious results. In examining the past and looking toward the future, we must work much harder to develop many more and better medicines to prevent sickness and preserve good health.

10. Oppose Rightism, Arouse Dilligence, Achieve Good Results In Both Production and Ideas

Pages 44-46 (excerpts)

Yung-li Chiu-ta T'ang-ku
Plant Superintendent's
Office

In mobilizing the masses to greater efforts, the first step is to set the objectives very clearly. This should be followed by attractive slogans, revolutionary methods, and "short distance" contests. For example, the leap forward production quota for September was 26,800 metric tons of soda, including 20 days with output surpassing 950 metric tons; these standards were higher than anything achieved in 1958 and months preceding September 1959. September output of soda is a crucial month not only for fulfilling the goals for the third quarter but also for the whole year; it is necessary to think of every means to surpass the assigned quotas. We studied the problem from all sides, carefully analyzed the situation, and came up with the slogan "chase hard in the first ten days, exceed in the second ten days, and hold tight in the third ten days." Later developments showed that the quota for the first ten days was exceeded and that the 950-ton per day objective was achieved two days ahead of schedule; we then raised our sights to 1,000 tons in the second ten days and introduced the new slogan of "1,000-ton week." The 1,000-ton standard was also achieved; in fact, for seven consecutive days, the average daily output was 1,004 tons. Finally, we suggested the plan to fulfill the September quota a day and a half ahead of schedule to welcome the National Celebration. In this manner, we can achieve the "307,000-ton year." The advantages of this method are "short distance," clear fighting targets, and attractive slogans that can be easily visualized and mastered by the masses; this approach means more effective results.

11. The Tremendous Achievements of the Small Native Group Chemical Plants in Honan Province

Pages 53-54 (excerpts)

Honan Chemical and Petroleum Industry Bureau

The chemical small native group movement is an important part of the economic revolution of Honan as well as the turning point toward more rapid development of the province's chemical industry. The industrial foundation of Honan Province has been weak, and the chemical base even weaker. According to statistics for the end of 1957, there were only 34 chemical plants of province and hsien level and above and most of these are "further processing" plants which make less than 20 types of products. The great masses well know that the chemical industry is intimately related with heavy industry, light industry, agriculture, transport, and other economic sectors, as well as the people's livelihood; hence, its rapid development is necessary. At the same time, resources required in the development of the chemical industry are extensive and widespread; there is much hope of economic improvement through the chemical industry. The Party's policy of walking on two legs is necessary from an objective viewpoint and fulfills the people's aspirations. The glorious slogan of the Party like thunder immediately became an important force in stirring up the masses to great efforts in the development of the chemical industry.

In the last year or so, the rate of development in the chemical industry of the province has been without parallel. For chemical plants established at the hsien level and above alone, there are 256 units. In addition, thousands of chemical plants have also been built by communes and other groups. Thus, small native group chemical plants exist all over the province. Product types have increased to more than 260, representing more than a tenfold increase over the number in 1957.

Parallel to the great leap forward of industrial and agricultural production, the Party and the people started last summer to work on native style chemical fertilizer and "agricultural insecticide plants and, within a few months, established many units in the province's hsiangs and communes. As a result of developing native production of chemical fertilizers and agricultural insecticides, the quantities of these materials consumed per mou of cultivated land for the year reached 370 chin and 3 chin, respectively, thus assuring the great increases in grain production. In the fall of last year, after the Party and Central Government created the slogan of "double the steel production," the battle to produce more nitroglycerin, sulfur, and explosives so as to support steel commenced and, within a month, more than 500 native explosives plants were built and 1,700-odd tons of

explosives were produced (excludes output by communes). This greatly helped the steel industry and altered our province's position of "little iron and no steel"; in fact, Honan has been transformed into an important steel producing province this year.

Following the over-all leap forward centered around steel, we have also done a great deal of work since last winter and this spring on basic chemicals with emphasis on acids and alkalies and on the development of chemical raw material production. In the first half of this year, the small native group chemical enterprises provided important proportions of the chemical products used by the local industries of the province, as for example 30-50% of the sulfuric acid, 60% of the hydrochloric acid, 35-40% of the rubber hoses and belts, and all of the ores for making soda and sulfuric acid. In addition, there were surpluses of sulfur and potassium nitrate for distribution to other provinces and sale abroad.

Large quantities of ores and other chemical raw materials have been discovered through the small native group movement. We relied on the masses to search for ore, report findings, and organize special exploration teams. Investigation of chemical raw materials in the province has been on a scale never done before, and exploration was extended to steep mountain peaks and broad river valleys. At present, for pyrite and phosphate ore alone, more than 20 deposits have been discovered and extraction by native methods has commenced.

Through the development of small native group chemical enterprises, a large corps of chemical workers has been trained that should be of great importance to the future development of the chemical industry in Honan Province. Statistics show that the number of chemical workers in the chemical plants of province and hsien level and above totals 35,000 this year, or five times more than the number in 1957.

The small native group chemical enterprises, after being reorganized and consolidated in the spring and summer of this year, are now much more efficiently operated in terms of better techniques and better management. Many small native group plants have been expanded and modernized and, through greater use of electricity and better equipment, are moving toward native-modern and modern methods of operation. Many small plants, including those under the communes that formerly employed several tens of persons; output by these plants has therefore risen greatly. Output value in the first half of this year was about two times greater than that in the entire year of 1957. Of 13 main products, mid-September statistics show that the 1959 output targets for five--soda, caustic soda, hydrochloric acid, rubber hoses, and rubber belts--have been achieved 110 days ahead of schedule.

II. ARTICLES FROM ISSUE NO. 20, 21 OCTOBER 1959

1. Guarantee the Overfulfillment of This Year's Construction Plan and Actively Prepare for a Greater Leap Forward Next Year

Pages 1-3 (excerpts) Editorial Department

This article has been writeen by the Editorial Department of this magazine from abstracts of records pertaining to the National Conference on Chemical Industries of 17 October.

To carry out the further great leap forward in the basic construction work for the chemical industry during 1960 along more, fast, good, and economical lines, we have to follow more closely the Party's main line in rousing the masses to greater efforts, in adopting every conceivable effective measure, and in mobilizing all resources so that the latent productive capacities can be fully realized. We believe that we should perform the following major types of work well.

1. A rational development plan for the chemical industry should be formulated according to the policy of the Central Government and objectives set for the industry. Since helping agriculture is the main function of the chemical industry, we are making the most investments in basic construction for producing chemical fertilizers and insecticides. To effectively meet the needs for the great leap forward in the light, heavy, communications, and transport industries, we also should quickly expand basic chemical industries, such as the acids and the alkalies. The "heavy" organic synthetic industry, especially in synthetic rubber, will also be a focal point in basic construction during 1960. In addition, in considering the most effective methods for integrated utilization of resources with regard to the chemical industry, we must also develop vital projects for large scale investigations, for better application of techniques, for industrial design purposes, and for training a corps of technicians in preparation for further rapid expansion in the future.

2. We must firmly carry out the policy of "large, medium, and small combined and native along with modern methods." The record in 1958 and 1959 definitely proves that this policy has a determining influence on the rapid development of the industries in the country. By pushing small native groups and small modern groups, we have not only solved the problems of meeting local needs and in training personnel but also the basic problem as to whether our country's socialist basic construction can leap forward from year to year. In the great accomplishments of our country's socialist construction during the last year or so, the "leg of small native (modern) group" has had an important effect. Developing small native groups and small modern groups is an indispensable avenue for the rapid development of our country's chemical industry.

What should be the further development of the chemical industry during 1960? The correct attitude we should take is that we must not waver on expanding medium and small scale chemical industries. Our tactics in expanding construction should be the emphasis on the "medium and small" but treating the "big and modern" as the core. During the National Conference on Chemical Industries held at Nanking in the spring of this year, many comrades did not clearly understand the significance of the medium and small scale chemical industries and felt that they were forced to develop these. Now, our thoughts should be entirely clarified. The 1960 basic construction responsibilities for the chemical industry are very great, and some of the output for the year will have to come from the newly constructed or expanded facilities. If we put the emphasis on building more large plants, then, because the supply of necessary heavy equipment is a long range proposition, our construction objectives might be affected. On the other hand, if we put the emphasis on medium and small scale enterprises, not only is the necessary equipment less and generally can be made by provincial and city machinery plants, but much materials like ceramic products, glass, and plastics can also be used. Results prove that the medium and small plants have many advantages, including greater speed of development, less investments and materials, use of local materials, reduction of long distance haulage, and more easy solution of technical manpower. Meanwhile, by building more small plants and later consolidating and expanding them, the problem of high cost can be gradually solved (this disadvantage has actually been compensated by the quicker supply of chemical products to expand agricultural production.)

Some people are dubious as to whether medium and small scale production can overcome the technical and economic barriers. Our view is entirely different. At present, 64 products are meeting technical specifications and 10 more are being further investigated. We feel that supervision is the basic problem, and there is no reason why this cannot be well done.

2. Let The Sulfuric Acid Basic Construction Projects Enter Production Ahead of Schedule Opposing Rightism, Arousing Diligence, and Attaining a More Rapid Leap Forward

Pages 4-5

Chang Chen, Vice Minister,
Ministry of Chemical Industry
(abstracts of meeting held
18 October)

In the leap forward of last year and the continued leap forward of this year, sulfuric acid requirements have become more urgent. Because of the shortage of sulfuric acid this year, some phosphate fertilizer facilities have been idle and by-product ammonium sulfate production has also been affected so that the over-all output of chemical fertilizers has been greatly curtailed---obviously detrimental to agriculture. The shortage of sulfuric acid has not only influenced the production of fertilizers and other chemical products but also has affected the metallurgical, heavy, light, and other industries. Therefore, it is necessary to find every means for raising sulfuric acid production. This year we must fulfill the "second account" and strive for the "third account" with regard to sulfuric acid production. To meet these targets, we must work hard on the following two lines: on the one hand, we must fully uncover the latent capacity of old plants for greater production; on the other hand, we must bring basic construction projects into production ahead of schedule.

The new capacity planned for this year corresponds to 2.5 times the total new capacity created during the First Five-Year Plan period ; the portion by medium and small plants equals the total new capacity created in the First Five-Year Plan period, which shows the wisdom of the Party's main line and "two legged policy" with regard to the chemical industry. These construction items have shouldered part of the production responsibilities for this year. The newly completed production capacity by the end of September was 26.91% the year's target, which means that 73.09% is yet to be completed in the fourth quarter. We require the Szechwan Chemical Plant to enter production by mid-October, the Fushun Petroleum No. 2 Plant by the month of October, the K'ai-feng Chemical Fertilizer Plant by November, and the Hsiang-fen Sulfuric Acid Plant, also by November. We must strive to bring the Kwangchow Nitrogenous Fertilizer Plant and the Fuchow Sulfuric Acid Plant into production by the end of the year also. With regard to small contact sulfuric acid units, we must surpass the plan of 700 and try to build 1,000. This is not only an economic responsibility but also a political responsibility. We must make sure that the targets are met. Can we achieve this? We believe we can.

1. To ensure the fulfillment of production and construction responsibilities, we must oppose rightism, arouse diligence, mobilize

the masses, stress the movement to increase production while making savings, and stimulate enthusiasm in contests. Contests in basic construction should start from sulfuric acid plants, especially for plants that come into production this year--contests for quality, safety, cost, work in the communist spirit, and degree of mass enthusiasm. The supervising cadres should personally go to front lines of construction and the organizing cadres should work side by side with operational workmen and, during critical times, must not leave the place of trouble. The synthetic ammonia project of the Szechwan Chemical Plant was scheduled to be brought into production by October; at the beginning the supervisors did not have enough confidence that this could be done but, after opposing rightism, arousing diligence, and receiving help from provincial and city officials who personally went to the plant to direct work and mobilize the workmen, finally the trial production run for the plant was achieved ahead of schedule, on 27 September. This is only one of many examples, but it stresses the importance of political leadership.

2. It is necessary to successfully implement the communist way of cooperative effort, as suggested at the Eighth Plenary Session. This would be very helpful in accelerating basic construction. We have done many things through joint effort, which in the past were thought to be impossible. The K'ai-feng Chemical Fertilizer Plant sulfuric acid project was scheduled to be brought into production during November; there was no power source and the monumental proposition of bringing high tension electricity from Cheng-chou, some 90-odd kilometers away, was initiated. With the support of high-level Party members of the province, especially those in the electric power department, the Cheng-chou--K'ai-feng electric line direction corps was established. The work was contracted in three sections through K'ai-feng City, the Chung-mo Hsien, and Cheng-chou City. By mobilizing the manpower and resources of all factions, work started at the beginning of October and the plan is to furnish electricity beginning 15 November; thus, the electricity needed for sulfuric acid production can be assured. Help provided by various "brother plants" to the Szechwan Chemical Plant have also been very essential; for instance, the Lanchow Chemical Plant sent eight steam fitting workers and the Dairen Chemical Plant sent ten lead welding workers. The Szechwan Chemical Plant in turn dismantled three units of already-installed nitrogen-oxygen blowers and sent them to the Kirin Chemical Industry Company; similarily, the Kirin Chemical Industry Company dismantled three units of mercury rectifiers to help out the Chin-hsi Chemical Plant. There are many other such examples. We commend the attitude of sending material and manpower to help other plants, especially when one plant cannot use them or does not need them urgently. We approve of "first other people and then oneself" and are against "self-position attitude." Any "evasions" or "gripes" are not compatible with the great leap forward circumstances.

3. An important aspect in fulfilling basic construction plans is the reliance on provincial Party direction to solve cooperative efforts. In constructing the facilities for the K'ai-feng Chemical Fertilizer Plant sulfuric acid project, K'ai-feng City organized seven machinery plant units to work at the project site; some units even dismantled their rolling equipment and transferred them so that the work on plant construction can be better coordinated; the province also helped solve many material supply problems. At present, some difficulties still exist with regard to the quantities of materials and equipment, product specifications, and delivery time for the various projects under construction. The provincial and city authorities should be able to help solve such problems through some kind of joint effort, even should it be necessary to borrow and return later. The important point is to meet schedules in bringing plants into production.

We strongly believe that by following the slogan of the Eighth Plenary Session the staff and workers in the front line of sulfuric acid plant construction will be able to achieve outstanding results through the already successful "Red flag contest movement."

3. The Rapid Development of the Chemical Industry in Hopeh Province

Pages 14-16 (excerpts) Chang Po

A Rapidly Growing Chemical Industry Corps

Prior to the Liberation, there was hardly any chemical industry in Hopeh Province aside from the plant in Tientsin. Actually, even Tientsin City did not have much of a chemical industry. In the 35-year span from 1914 (the year when the Chiu-ta Salt Manufacturing Plant was started) to 1949, only a number of simple, crude, and technically backward chemical plants were built, most of which were "further processing" plants. Plants with a working force exceeding 100 persons can be counted, and the over-all employment average was only 20 persons. These plants produced some 350 types of products.

Ten years after the Liberation, the province already has 234 plants of "hsien level and above," including those producing acid, alkali, inorganic chemicals, chemical fertilizers, insecticides, basic organic raw materials, plastics, chemical fibers, dyestuffs, paints, colors, chemical reagents, solvents, additive agents, rubber processing, pharmaceutical, chemical ores, etc. There are "further processing" plants along with the basic raw materials plants. The province produces more than 6,500 kinds of chemical products, some of which have a good international reputation. The corps of chemical workers is steadily being built up; as of now the number exceeds 80,000. During the leap forward of 1958, a large group of technical workers were promoted from the ranks of the workmen. These technicians are now capable of doing independent research, and can design medium and large scale plants.

This year the output value of the Hopeh Chemical Industry represents more than 10% of the total for all industrial products. Some chemical products occupy important positions in the over-all national production. According to estimates based upon this year's production plans, caustic soda is 24% of the national total, soda ash 38%, insecticides 60%, antibiotics more than 50%, dyestuffs more than 30%, paints more than 25%, and rubber processing and plastic production also occupy fairly prominent positions. These data show that our province's chemical industry is a very important part of the country's chemical front.

Ten Years of Rapid Development

The total output value of the province's chemical industry was only 25 million yuan in 1949. In three years of rehabilitation, the output value in 1952 rose to 3.4 times greater than in 1949; the average yearly increase was 63.8%. In the last year of the First Five

Year Plan (1957), the output value had risen another 4.33 times greater than in 1952; the yearly increase in this period was 39.7%. In the first year of the leap forward (1958), under the stimulus of the main line and hard work by the staff and workmen in fully utilizing the potentials, producing more new products, and constructing on an ever-expanding scale, the province's chemical output value increased 1.21 times over that in 1957 and was 48.79 times the value in 1949; the rate of increase during 1958 was about 3 times the planned rate in the First Five-Year Plan period. This is an exceptional record achieved by the working force of the chemical industry under the reflection of the main line.

The three years of rehabilitation, the First Five-Year Plan, and the great leap forward of 1958 are giving the impetus for a continued leap forward in 1959. The rate of advance this year should be 50.4% greater than that in 1958 or 76.6 times the rate in 1949. After ten years of glorious accomplishments, the chemical industry of our province like other industries has assumed an air of confidence in moving forward rapidly.

The achievements of Hopeh in the chemical field during the last decade has been brought about by centralized planning and efficient direction by the provincial commissioners and the provincial peoples representatives. Not only have the old enterprises been modified or expanded (for example, the Yung-li Chiu-ta "ku" plant), but many new modern chemical plants have also been established, as for example the North China Pharmaceutical Plant built with the assistance of the Soviet Union. Not only are chemical raw materials produced, but large, medium, and small plants engaged in further processing numbering in the hundreds have also been established. The chemical industry of Hopeh Province, under the reflection of the main line and under the direction of central and provincial governments, is steadily moving forward.

The Greap Leap Forward of 1958

The year 1958 was not an ordinary one. The people held high the red flag of the main line---everything was under political guidance and every one was working very hard in striving for the up-stream. Therefore, not only has the chemical ouput of Hopeh Province more than doubled, but accomplishments were also achieved in operations, techniques, qualities, new products, industrial management, etc.

Through political leadership in carrying out the mass movement, the Communist spirit of dare-to-think and dare-to-do was introduced in the field of technology and the result has been technical revolution, technical improvements, everybody volunteering ideas, and a steady series of new technical accomplishments. The 1958 statistics

show that 166,740 items on improved techniques of fair importance were introduced. Included are "soda ash production ten-tower one-group technical improvements, caustic soda production raising-current density, raising the 'propyl' content of 666, improvements in tools, savings in materials" and other propositions to improve quality, productivity, and equipment utilization. As a result, production of chemical production has assumed a new complexion. Compared with 1957, sulfuric acid output rose 31.13%, hydrochloric acid 23.72%, caustic soda 35.45%, soda ash 30.17%, "666 powder" 40.52%, tires and tubes 149.06%, paints 116.67% and dyestuffs 10.78%. As a result of the North China Pharmaceutical Plant being brought into production, the pharmaceutical industry has basically changed in complexion and its output value for 1958 was 3.53 times greater than for 1957.

The multitude of staff and workers, in liberating thought and expanding mass type of research work, have made many new products on a trial basis as well as improved product quality in general so that the over-all technical level of the chemical industry have shown definite progress. In 1958, a total of 1,034 new products were made on a trial basis with 350 kinds subsequently brought into production. Many of these products are much needed in our country's basic construction, including polyvinyl chloride, ion exchange resin, chain oxygen resin, phenol, organic phosphorus, insecticides, activated dyestuff, high quality paints, and metallic sodium; in the field of synthetic medicines, there are products like vitamin B_1, fever-relieving medicine /acetanilide?7, and antibiotics (penicillin and streptomycin are produced in large quantities and tetracycline and terramycin are also made). These many products not only show the growing scope of the various branches of the chemical industry but also the fact that we are entering the stage of being able to master new and complicated techniques. With regard to product quality, most of the products are of equal quality and meet standard specifications. The pharmaceuticals conform to requirements, and export products like soda ash, caustic soda, soda sulfide, high-quality paints, dyestuffs, etc., have some reputation in international markets. The foregoing indicates that many types of chemical products made in our province have reached advanced levels.

In 1958 there was also a great leap forward in basic construction; investments during the year exceeded the total for the whole First Five-Year Plan period. A total of 159 units were then being constructed, including the North China Pharmaceutical Plant (already brought into production), our country's largest chemical fiber plant and movie film plant (both at Pao-ting and either partly in production or still being constructed), and the newly constructed Tientsin Chemical Plant polyvinyl chloride unit. Plants expanded included those producing soda ash, caustic soda, and tires and tubes. Such large scale chemical construction work had not been done before in Hopeh. After these construction projects are all brought into production, aside from the fact that production will

be greatly increased, the technical base of our province's chemical industry will be greatly strengthened to create favorable conditions for a continued leap forward in the future.

By carrying out the correct policy of walking on two legs, the development of the chemical industry has been greatly accelerated. While constructing large modern chemical enterprises, many small plants numbering in the thousands have also been built in the rural areas, including native chemical fertilizer, bacteria fertilizer, native agricultural chemical, and other plants; the contribution of these small plants to agricultural production is difficult to estimate. However, it can be said that the small plants trained many workers and the knowledge gained should be important to the future development of the chemical industry.

A Situation of Continued Leap Forward

The 1959 plan called for a production value increase of 44% over that of 1958. When the plan was first carried out, there were instances of rightist afraid of difficulties with regard to the supply of necessary raw materials and equipment spare parts. The truth was exposed in the Jen-min Jih-pao editorial of 6 August and the directive of the Eighth Plenary Eighth Session whereby the rightists were criticized. Now after discussions with the staff and workmen, we have revised the production plan and the rate of output value increase has been raised 50% above that of 1958.

Progress has been very good this year, quotas for various items having been surpassed during the first half of this year. Compared with the same period last year, sulfuric acid has increased 19%, caustic soda 13%, soda ash 19%, "666" 18%, and antibiotics 50.6%. July output was affected by the loose thinking of the rightists. The trend was reversed in August as a result of political direction to stir the workers to greater efforts in welcoming the tenth anniversary of the national holiday and, for enterprises under the Bureau, output for August actually surpassed the target by 10.6%, or 20.6% greater than in July. Tientsin surpassed its target by 10.87% in August, an increase of 34.64% over the output in July. From an objective point of view, conditions were not too different between July and August except that there was not enough work spirit in July. We must conclude that better direction will achieve better results.

This year we have not only surpassed targets in production but also in basic construction with regard to work quality and bringing more new items into production. A good leap forward foundation has been created for 1960 and we believe that further great progress will be achieved in 1960.

4. Take the Lead Politically and Leap Forward in Basic Construction and Production

Pages 18-21 (excerpts)

Party Committee of the Lanchow Chemical Plant

According to the program of the First Five-Year Plan, it was determined that a large scale chemical fertilizer plant and a large scale synthetic rubber plant were to be established in Kansu Province. These two plants are the chemical bases of the Northwest.

Auxiliary engineering work was started in 1956, and plant housing construction began in April of 1957. It was during this period that the Party and Central Government issued the directive for the rectification movement, which our province immediately carried out. We began to realize that victory in construction must be based upon victory in political thought. Results have proven that the movement not only trained the Party cadres but also the staff and workmen as well in the methods and concepts of socialist construction. The major obstacle of rightist conservatism was overcome. The masses were mobilized for greater effort. The way to greater production was opened.

We engaged in four construction battles in 1958, in which we were victorious each time: trial run on "1 May," completion of drying equipment on "1 July," production of methyl alcohol by the "national holiday," and production of ammonium nitrate by the "October revolution anniversary." Thus, the first stage of construction for the synthetic ammonia plant was completed and brought into production a year and a half ahead of schedule. Such is the result brought about by the rectification movement and the socialist construction main line. In basic construction for 1958, the investment plan was fulfilled by 149.8%, the productivity plan by 130%, the cost reduction plan by 213%, and the "plan on savings" by 136.8%; in total, we saved more than 37 million yuan in investments and in excess of 5,000 tons in steel materials. In production, although no production targets were assigned, we produced products valued at 6,750,000 yuans. In the "steel battle of 1958," through the direction of comrades at the front in stirring the masses to greater efforts, we produced 3,024 tons of steel by native-modern combination methods and fulfilled the steel target by 111%. In the field of assisting local industries, we made steel refining equipment of 125 tons capacity, helped to construct various small acid, metal, and agricultural chemicals plants, and assumed the responsibility of manufacturing and installing high-pressure equipment related to a 2,000-ton fertilizer plant. Important help was given in training workmen and in making ball bearings and shafts.

As of now, the Lanchow Chemical Plant has already become a complex enterprise with three sub-plants, one company, a sectional design

institute, a research station, and a chemical engineering institute. Its mission of becoming the chemical base of the Northwest is already taking shape. This is a victory of the main line and a good example of achievement through Sino-Soviet friendship.

During the first half of 1959, our production and construction targets have all been fulfilled, despite extreme difficulties in raw material and equipment supplies. With regard to plan fulfillment, production was 106.2%, basic construction was 102.3% (in terms of investments), investments for purposes of making savings was 103%, and cost reduction was 101%.

5. Construction of a Self-Designed Modern Chemical Plant

Pages 22-24 (excerpts) The Szechwan Chemical Plant

When all the people of the country were celebrating the Tenth Anniversary Holiday with their glorious achievements, our country's largest chemical enterprise in the Southwest--the Szechwan Chemical Plant--was making trial runs on production for part of its units. Within the year, the plant's first stage projects, including synthetic ammonia, sulfuric acid, ammonium sulfate, and other related units will have been entirely brought into production.

The design of the Szechwan Chemical Plant was done under the direction of Soviet specialists. Thus, the whole process of design was also a stage of learning Soviet techniques.

In the process of design, the capacity was raised several times. Actually, more than 45% in capacity was added to the original design by drawing the experience from other producing plants, making new equipment balances, and adding amounts of investment and equipment.

In supplying equipment and materials for this plant, the principal has been to use as much domestic manufactures as possible although help was also received from "brother" socialist countries. Czechoslovakia supplied the main equipment for the synthetic ammonia unit, such as high-pressure tanks, high-pressure compressors, refrigerating equipment, large size blowers, high-pressure pumps, etc. The Soviet Union supplied some items not yet produced in the country, such as especially big or especially small diameter seamless tubes (or pipes) and especially thick steel plates. Aside from the equipment mentioned above, all other equipment, instruments, high-pressure pipes, and supplies for the whole plant were furnished by domestic manufacturers. A total of 254 plants from 18 provinced and 2 special cities around the country made equipment for the Szechwan plant. To install equipment ahead of the original schedule, under the over-all direction of the First Ministry of Machinery Industry, the Ministry of Chemical Industry, and the Second Ministry of Machinery Industry assigned certain units to manufacture on a trial basis a number of types of equipment which were to have been procured from abroad. Included among the items were the first unit of "red flag brand" high-pressure compressor made by the Northeast Machinery Manufacturing Plant by the "ants biting at a piece of bone" method, and large size horizontal blowers, pump-fly wheel combination pump, large pumps, centrifuges, large size electric motors, and transformers made for the first time on a trial basis by other plants. In addition, the machine shop and "further processing" unit of the Szechwan plant also made many units of special equipment.

In the general leap forward of industrial construction, when much steel and other materials are needed, it was necessary for the Szechwan plant to reduce its consumption of these materials. Faced with this new development, it initiated a mass movement to inspect production and make technical improvements with a view to savings; the emphasis was placed on building and installing equipment from our own resources, with less dependence on the outside. The whole staff and workmen assumed the air to "dare-to-say and dare-to-do" and tried in every way to solve the difficulties in the supply of materials, equipment, tools, and transport facilities. By using the approach of native-modern combination methods, many "shining star" plants were built to produce such materials as iron and steel, silicon-iron (steel), carbide, refractories, and bricks and other construction materials, which could not be furnished from outside sources. The measures taken followed the policy of "simplicity, delay-action, fighting attitude, substitution, procure materials locally, and cut the material to fit the dress." For lack of adequate "machinery fabrication strength," the machinists were organized to make such products as pipe fittings, valves, electric motors, and high-pressure pressure gauges to fit machinery not meeting specifications when received, and unusual types of equipment. In the process of making equipment, many advanced techniques were learned and applied, as for example electric arc planing, aluminum welding, welding or soldering of leaks, etc. All these activities have been very important in accelerating the completion of construction projects.

6. The Appearance of a New Plastic (Polypropylene) in The Great Leap Forward

Pages 24-25 & 36 (excerpts)

Wang Shu, Shanghai
Chemical Industry
Research Institute

The appearance of a new plastic--polypropylene--made by the "vertical or solid column" principle polymerization process has added a new raw material of good quality to the plastics and synthetic cellulose industries. Italy started to produce this plastic on a trial basis in 1957, and gave it the trade name of "Moplen." Thereafter, the Soviet Union, the United States, the United Kingdom, etc. also produced it in fair amounts.

We used the same method and principle to produce the polypropylene on a trial basis. We are endeavoring to catch up with the advanced world levels in making this product with regard to characteristics, techniques, and equipment.

The flowsheet for making polypropylene is shorter than those for polystyrene and polyvinyl chloride and is similar to the constant pressure method of making polyethylene. Its raw material--propylene--is a by-product of the petroleum industry, which is cheap and can be obtained in large quantities. We must develop polypropylene quicker so that this new plastic can serve our country's socialist construction program at an early date.

7. A 4,000-Ton Contact Process Sulfuric Acid Plant Overcomes Economic and Technical Obstacles and Goes Into Regular Production

Page 26 Unsigned article

A 4,000-ton contact sulfuric acid plant, run on a trial basis and modified by the Shanghai Chemical Industry Research Institute for more than a year, finally goes into regular production on the eve of the National Holiday, with capacity attaining design levels and product quality meeting specifications. This is an important event in the sulfuric acid production of our country and a revolutionary development in sulfuric acid operations. In addition, this 4,000-ton contact plant, following the native tower type and the native contact type, should become of great significance for wide application.

The birth of the new flowsheet designed for the 4,000-ton contact sulfuric acid plant is already a story of last year. The National Sulfuric Acid Conference of last year, sponsored by the Ministry of Chemical Industry, created much discussions with regard to plant design. Workers in the industry, in the spirit of "dare-to-think, dare-to-say, and dare-to-do," were determined to improve the already established contact sulfuric process and suggested the "4,000-ton contact method sulfuric acid water washing new flowsheet." Actual results in more than a year prove that this inventive-nature new flowsheet is both workable and worthy of wide application.

The main characteristics of the new flowsheet are: (1) the gas cleaning and drying sections are relatively simple. The simple venturi tube spouting cleaning equipment has been substituted for the complicated "electric dust-cleaning equipment, electric mist-elimination equipment, and cumbersome cooling equipment." (2) In drying and absorption, the modern high-efficiency (highly efficient) perculating bubble tower has replaced the cumbersome "fill material tower" with resultant great savings in investment. In addition, the plant construction time for this process is very short, only a little over two months being necessary. The characteristics of simplicity of equipment, speed in construction, low investments, and quick results truly conform to the spirit of "more, fast, good, and economical."

A new development of this kind usually does not have smooth sailing all the way. Many difficulties were encountered in the experimental stages of building the 4,000-ton contact sulfuric acid plant. With the full support of the Ministry of Chemical Industry and the Shanghai Chemical Industry Bureau, the Shanghai Chemical Industry Research Institute and the experimental plant combined their resources

to design and modify the equipment. After more than a year of trial use and modifications, the entire equipment of the plant has been normalized--production is stable, dust is low, the absorption and other technical indices all conform to design requirements, and the intensity of fluo-solid roasting has reached international standards. This accomplishment gives much inspiration to technical improvements in the chemical industry as a whole.

The Ministry of Chemical Industry, to spread the use of this technique in many other parts of the country, immediately called an "on the spot" conference in Shanghai just before the National Holiday. During the conference, the Shanghai Chemical Industry Research Institute and the sulfuric acid plant people described the construction and production experiences in detail to everyone. After discussions, all representatives were in agreement that the new production method developed at Shanghai is a workable method that should be widely employed elsewhere.

Finally, the Ministry of Chemical Industry immediately decided to rapidly bring into production all such 4,000-ton contact sulfuric acid plants allocated last year and, at the same time, develop plans for these plants in next year's program. This "new branch of fresh troops" in sulfuric acid production should greatly exert itself in our country's leap forward plans.

8. A Few Problems Relating to Native Contact Process Sulfuric Acid Production Worthy of Attention

Pages 35-36 (excerpts)

Li Hsueh-ho, Shensi Province Chemical Industry Bureau

From the viewpoint of our province's state of production with regard to native process contact sulfuric acid, it can be said that all those standard plants constructed according to the design of the East China Chemical Industry Design Institute Sub-station are entirely capable of producing acid, with a daily output usually of 600-900 kilograms, sometimes 1-1.2 metric ton, and occasionally greater than the capacities designed. However, some of the native contact acid plants are not operating normally and the acid made may not have attained the 98% grade specified. Our bureau studied the problems from a number of plants that have been in operation. We feel that by paying more attention to the following aspects, the native contact plants not now operating properly will be able to produce on a normal basis.

1. The problem of blowers--Some of the blowers used in various areas have not been made according to standard designs; the quality of these blowers is not good and gas and acid leakages occur.

2. The problem of acid pumps--Most of the pumps used for acid are actually water pumps. Whether it be an acid or water pump, the problem is that the "plate base" is not acid-resistant, causing acid and gas leaks and inability to pump the acid up. Also, because there is no acid-raising equipment, the normal cycle of acid flow in the absorption tower is interrupted so that the absorption action is affected.

3. The problem of cooling sulfur trioxide--At present, the cooling equipment for sulfur trioxide is not of the type that is normally used. The main problems are: (1) low efficiency of cooling; (2) some cooling pies are made of copper and others do not have good connections on the two ends so that leakage of gas and water result; (3) in some cases the pipes are too narrow and there is no place to remove acid mud (the pipes are often plugged by the acid mud), causing the stoppage of gas flow so that cooling, as well as normal production, is affected.

4. The gas leakage and smoke problems for the whole system--Most of the systems employed in native-method contact sulfuric acid production, because of bad pipe connections and sealing, develop in varying degrees the phenomena of gas leakage, smoking, acid leakage, water leakage, etc.

5. The problem of maintaining temperature--At present, temperatures for most of the converters cannot be maintained; the wall for keeping the temperature up is usually not much more than 50 mm and does not meet design specifications. Yellow mud /clay/ is generally used for maintaining temperature and this material cracks when dried and hence cannot keep the temperature up. In some plants, the converter temperature cannot be kept at the required 430° C (in actual practice, often below 400°). In other plants, the intake temperature of the first converter is 550° C and the outflow temperature is 480° C; and the intake temperature of the second converter can be only 360° C.

III. ARTICLES FROM ISSUE NO. 21, 6 NOVEMBER 1959

1. Two Legged Development of the Chemical Industry in Honan

Pages 5-7 (excerpts) Chang T'an

Last summer when the small native group movement first got underway, it was natural that the masses did not know much about the chemical industry. Some technical people as well as officials in various agencies felt that the development of the chemical industry could not be by small scale native methods and, since the masses do not have any technical background, there could not be much progress at all. These people conveyed the impression that knowledge of chemistry is sacred. All these arguments are contrary to the two-legged movement and to the mass line. The rapid development of small native enterprises since that time fully refutes their arguments. In a period of a little over a year, the products produced by small native group chemical plants in our province total in excess of 200 and, among the more important products, their combined productive capacities reached 20,000 metric tons for sulfuric acid, 7,210 tons for hydrochloric acid, 16,000 tons for soda ash, 7,210 tons for caustic soda, 104,968 sets for tires (probably bicycle), and 888,600 meters for rubber hoses (probably 1-inch size). Output by small native group chemical plants is now an important portion of the province's total production. If we walked only on one-leg and developed large plants, it would be impossible to develop a large capacity and so many kinds of products within a short period because Honan Province has a weak base for industrial development.

This spring, because some products were not carefully examined with regard to economics and techniques, production cost was a little high and some people began to doubt the feasibility of small native plants and others were openly against them claiming that more development means more losses and it would be better to admit the mistake and forget about the program. However, we believe that since equipment used by small native methods is simple there must be a period of trying to master techniques; therefore, low output, low product quality, and high cost are natural phenomena of this transition stage. To forsake the small native group movement without reevaluating its possibilities is an underestimation of the intellect and strength of the masses. Can the small native group plants pass the technical and economic barriers? An affirmative answer has already been proven in practice. At present, except for the 1,000-ton ammonia-soda method of making soda ash, all the rest of the small native group chemical plants in our province have passed the technical barrier. The quality of 11 major products--sulfuric acid, hydrochloric acid, soda ash, caustic soda, sulfur, potassium nitrate, rubber hoses, bicycle tires, rotating belts, and "triangular" belts--has either reached or bettered

prescribed standards; production cost also has declined markedly. Statistical data for the province show the following cost reductions in comparing August with January: sulfuric acid, 52.1%, soda ash 32.6%, and caustic soda 37.98%. According to several recent conferences called on cost analysis, there will be further marked declines in production cost for many products during the coming fourth quarter, as a result of measures taken in the way of integrated utilization, integrated operations, technical improvements, more efficient labor organization, and strengthening of management of enterprises.

Some people think of the small native group operations as temporary in nature and should not be further developed. This is a passive attitude of rightist thinking. Obviously, from native to modern is the direction of development for the small native enterprises, but it should be recognized that new native methods will still come about. At present, the small native groups in the chemical industry should be expanded to communes in order to better serve agriculture; also, more emphasis should be placed on integrated utilization and development of greater variety of products. Only in this manner will the chemical base be broadened.

In the construction of the large modern group of chemical plants in our province, we are likewise battling conservative rightist thinking.

Some people feel that medium and small plants and mines can be developed on the provincial or city level but that relatively large plants (like the K'ai-feng Chemical Fertilizer Plant) cannot be built as yet because of inadequate favorable conditions. They are particularly pessimistic with regard to equipment and materials supply difficulties and problems related to quality. Such views are really doubting the policy of simultaneous development by central and local authorities. There is no use arguing because not many big plants have yet been developed on the local levels, but this does not mean that it cannot be done. For example, the K'ai-feng Chemical Fertilizer Plant built on the provincial level with help on all sides is progressing smoothly. The province furnished the plant with many cadres and technicians as well as large quantities of equipment and materials, and organized K'ai-feng's seven largest provincially or city-owned machinery plants to make non-standard equipment for the 120,000-ton sulfuric acid unit of the fertilizer plant. Some machinery plants even dispatched machinists and other workmen to the work site and cooperated closely with the installation company to hasten the job. To solve the power source problem for the fertilizer plant, the province authorities decided to assign Cheng-chou, Chung-mo, and K'ai-feng to contract sectional work in order to bring the high tension power line from Cheng-chou to K'ai-feng; the goal was to make sure that power will be available to the fertilizer plant in a month and a half. At present, the 120,000-ton sulfuric acid unit of the plant, after only three months of installation

work, is about to be brought into production. This example proves that under the leadership and assistance of the central authorities, provinces and cities not only can erect large plants but can do a good job of developing them. By closely following the policy of coordinated central-local development and mobilizing resources from all directions, the development of the chemical industry can be greatly accelerated.

Some people think that while large plants can be built on the provincial or city level, much help must come from the outside. These people ignore the importance of building strength from within, and still think too much of central government help. Therefore, the thinking is unilateral rather than cooperative action. Such thinking shows up best with regard to solving construction and installation problems. These people believe in contracting everything out or, in other words, relying on help from elsewhere. They say that new soldiers cannot fight tough battles, showing that they are basically afraid of responsibilities in quota and work quality. Our thinking is entirely different for we believe that good soldiers are trained in battle. New soldiers are weak in techniques and weak in their ability to install equipment, but with the help of an experienced corps and assistance from "brother" units, these green soldiers will rapidly gain experience. For example, the Hsin-yang installation crew was thrown into battle within a month from the time it was organized and, under the direction of 20-odd technicains, completed in a little over a month the manufacture of a non-standard set of equipment for a 3,500-ton carbide plant, and installed the equipment, which is now in production. The K'ai-feng Chemical Fertilizer Plant Installation Company was also formed not long ago. However, with the help of an experienced corps of technicians from the Kirin Chemical Industry Company, it installed two 48,000-cubic meter blower units in August and, in the short span 10-odd days after mid-September, also installed more than 20 pieces of other equipment, with the result that the installation quotas for August and September were both overfulfilled. These are all good examples which clearly show that, if we depend solely on the outside and do not build up strength from within, the technicians and workmen cannot be trained and expanded rapidly, with the result that the future rate of development in the chemical industry will be affected.

2. Some Experiences Gained in Developing Small Native Group Chemical Plants

Pages 7-9 (excerpts)

Honan Province Chemical and Petroleum Bureau

In the movement to develop iron and steel on a large scale, we also organized mass movements to produce potassium nitrate, sulfur, and explosives to assist in carrying out the policy of "steel as the core." Within a month after holding an "on the spot" meeting, more than 500 native style explosive plants were built in the province. In the Shang-ch'iu area, an army of 100,000 is battling night and day to develop nitrates. Statistics show that, excluding output of explosives by communes, the province's production was 1,710 metric tons, which effectively helped the development of the iron and steel industry. Later, by going into small sulfuric acid, small soda ash, and other basic chemical plants, the chemical products made were also of great help to the economy during the leap forward program.

In the mass movement to develop small scale native method plants, as a result of arousing the masses to greater efforts and adoption of improved techniques, many startling achievements were brought about so that the small native group chemical plants were in effect moving ahead and being consolidated. For example, many 80-ton per year tower process sulfuric acid plants, after being technically improved by the masses, began to produce at above design levels; most of these plants were in fact producing 400 kilograms daily. The Kuan-hua Chemical Plant in the hsien capital of Shang-ch'iu, on the principle of integrated utilization and development of salt soil, nitrate soil, soda soil, and grass and wood ashes, is making more than 20 different kinds of products. The K'ai-feng Rubber Plant, started by 20-some women under the conditions of "no equipment, no technical personnel, but dare-to-think and dare-to-do attitude," developed the "pot-fried soda-boiled" reclaiming method and punctured the theory that this could only be done by "high pressure and high temperature"; the plant also used "noodle making type of native machines" to make bicycle tires, transmission belts, rubber hoses, etc. that met specifications. These examples show that by walking the mass line and relying on the masses, our strength and methods are unlimited. We can do new things and improve present methods.

We believe that to develop the small native group of chemical plants it is necessary to carry out the policy of "regenerating strength from within." This attitude we have taken from the start. The many small sulfuric acid, soda ash, carbide, petroleum, fertilizer, and other native method plants have all been built under the principle of "strength from within"; the necessary investment, equipment, materials, and technical manpower needs were primarily met by the plants' own

resources. For example, the transformers and other equipment needed by the 1.5-ton carbide plant of the Cheng-chou Hsi-t'ai-k'ang Road People's Commune were solved by the commune itself. As long as there is good organization of the masses to regenerate strength from within and with good direction and help from outside, the difficulties met with in developing small native group plants can be quickly overcome.

3. Everyone Engaged in Development of Small Native Group Chemical Plants in Hupeh Province

Pages 10-11 & 30 (excerpts) Chang Hua-wen

The chemical base of Hupeh Province was very weak. In the early part of 1958, the province only had a 2,000-ton sulfuric acid plant, a 1,500-ton rubber baking plant, some Chinese medicine, western medicine, and animal medicine "further processing" plants, and small numbers of small and scattered plastics and rubber products plants. Since the leap forward, everyone has been engaged in industry under the leadership of the Party and the chemical industry. Despite limitations on all sides in equipment, raw materials, and machinery processing, rapid progress has been made in the past couple years and agricultural and industrial production as well as the needs of the people have been effectively assisted. Thus, the complexion of our province's chemical industry has changed from a backward condition to one which has a good foundation for future development.

The great progress in our province's chemical industry is seen in the following lines:

1. Product type and output have risen many fold--According to incomplete statistics, our province now can make 198 types of chemical raw materials and 123 types of testing reagents; if "further processed" pharmaceutical, plastic, rubber and daily use chemical products were included, the total number of products would exceed 1,000. Important chemical products such as the "three acids and two sodas," "agricultural medicine E605," carbide, polyvinyl chloride, furfural, phenol, etc. are produced in quantities not only adequate in meeting part of the needs of the province but also in some cases are available for shipment to other provinces and for export. With regard to output value and output tonnage, the 1958 output value was 1.45 times greater than in 1957 and the output value for the first half of 1959 was 1.1 times greater than that for the similar period last year. For one of the main products, namely sulfuric acid, the capacity already brought into production (excluding small native group plants) is 12 times greater than last year; after the new plants now being constructed are brought into production, the total capacity increase will be 39 times. Such rapid progress is unparalleled.

2. Techniques progressed from "further processing" to producing chemical raw materials and from simple lines to an integrated-system chemical front--The shortages in chemical raw materials during the leap forward gave the impetus to the chemical industry for using the regenerating strength from within approach to produce chemical raw materials. Searching for the source and connecting one ring to another, we started from a few enterprises and a few products and rapidly

developed the chemical industry to a state of integrated production of chemical raw materials as well as processed chemical products, and thus entered many basic chemical fields.

3. Started to develop nucleous enterprises and began to establish the chemical base--In the last year we started to build four projects on a provincial level and erected the framework for developing plants and mines. In addition, many medium enterprises are also being constructed. When these chemical bases are gradually completed, the complexion of our province's chemical industry will have been basically changed.

4. Distribution of the chemical industry has changed and chemical knowledge has become widespread--Prior to 1958, the few chemical enterprises in the province were primarily located in Wuhan with some at Yi-ch'ang. Now, chemical plants are distributed among cities, special hsiens, and people's communes. Through the widespread establishment of chemical industries, general chemical knowledge has become more common, chemical technicians have come from all parts of the country, and the technical manpower pool has been steadily built up so that favorable conditions have been created for the future expansion of the chemical industry. In this year's enrollment of students for universities and special institutes, the number of students expressing an interest in the chemical field is several times greater than previously; similarily, most of the students taking examinations for senior high schools also want to take up chemistry. The new interest in chemistry has undoubtedly been brought about by the widespread development of chemical industries.

5. Great progress has been made in scientific research--Within a year or so, the number of new products brought into production total 260 kinds, including 74 items produced as a result of successful experimentation. The subjects investigated are closely related to the characteristics of resources in our province and according to the concept of integrated utilization; thus, research has had an important effect on chemical construction in the province.

6. Extensive development of chemical ores to meet the raw material needs of the chemical industry--At present, the mines worked in the province total 108, including 81 pyrite mines and 17 phosphate mines. Production of sulfur in the first half of this year was 5.3 times greater than the first half of last year.

How did we achieve all these results? The most important experiences gained during the last year are in the following two aspects:

1. Reliance on all the people to develop chemical industries--For example, among the 189 chemical enterprises in Wuhan, only 17 are

directly under the Ministry of Chemical Industry, or 9% of the total; the rest of the chemical plants have been developed by commercial, light industry, electrical, textile, agricultural, handicraft, educational, civic affairs, financial, shipping and other groups. Some even belong to banks, hospitals, colleges and institutes, high schools, real estate companies, district governments, army, sanitation departments, and road departments; the plants are spread out in many areas. Commercial and light industry organizations have been the most active in developing chemical industries. Among the chemical products produced in the province, almost all of the testing reagents and most of the sulfuric acid by native methods are made by plants that do not belong to the Ministry of Chemical Industry. As a result of all the people developing chemical industries, the manpower, material, and financial pool of the chemical industry have been greatly increased, chemical construction has been accelerated, and product type and output tonnage have been substantially raised. With the various groups producing chemical products for their own use, costs have also gone down.

2. The walking on two legs policy has been successfully carried out in the way of jointly developing large, medium, and small enterprises and jointly undertaking native and modern methods. A strong chemical base for our province can only be established through accelerated basic construction. Results prove that small scale enterprises require less equipment and materials, simpler processing facilities, and less construction time; this explains why they have been very effective. We have the following thoughts regarding developing small native group chemical enterprises;

a. For most of the chemical products previously produced, no difficulties are encountered in designing plants. Some problems will arise for a few products that have not been made before, especially when equipment and operational methods do not conform with standard designs. However, all such difficulties are temporary in nature; they will be overcome when more practical experience is gained.

b. The production of any new product requires a period of mastering techniques, particularly in the case of small scale native plants which have simple equipment and few control gauges so that more dependence must be placed on man. We cannot be too hasty in trying to attain design standards; instead, special measures must be first implemented to raise the technical efficiency of the workers so that the production techniques can be quickly mastered. Results prove that when techniques are mastered, the small scale native plants not only can operate normally but, in the course of time, can also make savings in materials and cost. For example, the native tower type of sulfuric acid plant, after little overhalf a year of operations, for each ton of acid produced have reduced consumption of ores from two tons to one

ton, consumption of nitric acid from 70-80 kilograms to 40-50 kilograms, and production cost from 700-800 yuan to 400-500 yuan (lowest figure is 263.5 yuan per metric ton of sulfuric acid).

4. Small Native Group and Small Modern Group Chemical Plants Are Being Built Everywhere With Good Results

Pages 12-14 Unsigned article

Editorial comment: Since 1958, as a result of carrying out the central government's policy of walking on two legs, the chemical industry, like other economic sectors, has made very rapid progress. Not only has there been much development in provinces and cities where the chemical foundation was fairly good, but for areas which previously had little or no chemical industry, there has also been some construction on a preliminary scale, as a result of a year of pushing the small native group and small modern group movement. At present, for many chemical products, the small native group plants have already passed the technical and economic barriers and the movement to build small plants is rapidly moving ahead. Measured in types of products, number of newly developed enterprises, and the over-all rate of development, accomplishments in the last year far exceed those for the leap forward year of 1958. The people who were against or pessimistic about the small native group program have been strongly refuted.

In previous issues of this magazine, we have described the development of small chemical plants in Honan, Hopeh, Hupeh, and other provinces. We will now describe certain other provinces and special districts with regard to the achievements in the chemical industry small native group (includes small modern group) movement since 1958.

The chemical industry leaps forward along the whole front, and some products are even well known in foreign markets.

Inner Mongolia--Much development has taken place in the chemical industry of Inner Mongolia since 1958. Comparing 1958 with 1957: the number of chemical plants and mines for the special region has increased by 119 units (excludes those belonging to hsiangs and communes), output value has doubled, product type has risen from 14 to 50, and employment has gone up from 3,947 to 9,772; output of natural soda has increased 101 times, ephedrine by 33%, "kan-ch'ao-kao" by 46%, and caustic soda by 24%. This is the year of continued leap forward when product types will reach about 100 and output value will be in excess of two times more than that of last year. Also during the year, there will be 11 basic construction projects that will either be entirely or partly brought into production.

The rapid development of the chemical industry in the Inner Mongolia Autonomous Region is attributed to the success of the small native (and modern) group movement. The enterprises now in existence, aside from two pharmaceutical plants, are primarily native-modern

combination small to medium enterprises. Many products not previously made are now being produced, such as sulfuric acid, soda ash, carbide, phenol and aldehyde plastics, potassium nitrate, bicycle tires and tubes, rubber hose, large tires, terramycin, many types of testing reagents, solvents, etc. Some chemical products are produced in excess of requirements and are shipped to other provinces and abroad. Ephedrine and "kan-ch'ao-kao" have a good reputation in international markets.

The complexion of the chemical industry changes from day to day, and new products and new enterprises increase in number like the days.

Heilungkiang--The chemical industry of Heilungkiang formerly consisted of only a few "further processing plants." Through promoting production by small and medium scale enterprises, the chemical industry is rapidly changing in complexion, particularly in the field of chemical raw materials. Within the province, aside from using native methods to produce basic chemicals like acids and alkalies, organic chemical raw materials are also being developed. There are now ten-odd units producing carbide, their combined capacity being about 20,000 tons. A 300-ton per year phthalic acid anhydride plant and a 600-ton carbon disulfide plant have already been brought into production. Other operating plants include 1-ton per day acetone and methyl ethyl carbinol plants, 2-ton per day acetic acid plants, and aureomycin, chain-oxygen resin, and oxalic acid plants. In addition, the following products have been successfully made on a trial basis: styrene, "ni-lung 66," organic silica, etc.

While concentrating on production from small and medium plants, important basic construction work is also being done in the province. The plan is to bring the following large plants into production by the end of this year: Harbin Sulfuric Acid Plant, Sui-hua Synthetic Ammonia Plant, Chia-mu-ssu Acetone and Methyl Ethyl Carbinol Plant, and the Mu-tan-chiang Carbide Plant.

New flowers of the chemical industry are blooming everywhere, with a rich harvest in insecticides and chemical fertilizers.

Shensi--The total value of chemical output in Shensi Province during 1958 was 72,640,000 yuan, of 2.49 times greater than in 1957. Production of major products in 1958 had risen greatly over the 1957 levels: caustic soda increased 288%; borax, 207%; sulfur, 119.6%; injection medicines, 64.6%, insecticides, 101%; and "bubble flower" soda, 694%. This year is the year of continued leap forward. According to incomplete statistics for the first nine months of 1959, output value should reach 86,060,000 yuan; for the year as a whole the estimate is 125,000,000 yuan, or an increase of 72% over that in 1958 and 22% above the plan for 1959. For major products

in the first nine months of 1959 compared with the same period in 1958, the increases are as follows: caustic soda, 165%; sulfur, 480%; borax, 560%; injection medicines, 135%; and tablet medicines, 150%. At the same time, 120-odd types of new chemical products have been added to those already produced (73 kinds brought into production and 24 kinds are of the raw material type), including oxalic acid, phosphate salts, acetanilide, salicylic acid, "life saver rings," industrial activated charcoal, etc.

At present, there are about 500 small native type chemical plants in normal production in the various parts of the province. The chemical products produced by small native plants number 200-300 kinds; these products are of considerable significance to industry and agriculture. For example, large quantities of potassium nitrate and sulfur were produced last year and made into black powder, which was helpful to the iron and steel industry, and large quantities of native type insecticides and chemical fertilizers were produced to assist agriculture. In the spring of this year when wheat was struck with "strip rust sickness" and the supply of agricultural chemicals was inadequate, the Pao-chi City Pao-chen Commune Pan-hsi management region fertilizer plant quickly produced 2.66 tons of sulfur-containing insecticide and dispatched it to 12 production crews in Ch'uan-tao for use on 9,100 mou of wheat farms; the farm land treated with the insecticide ultimately produced 50 kilograms more per mou than the untreated land and resulted in a larger wheat output of 455,000 metric tons /455,000 kilograms/. The people were of course very happy about this.

Many chemical mines and plants have been brought into production, the scenery on the north and south sides of T'ien Shan has become beautiful.

Sinkiang—The Sinkiang Wei-wu-erh Autonomous Region, while having rich chemical resources, had hardly any chemical industry. Its complexion has undergone great changes since 1958 as a result of development of small native group type of chemical plants by the masses. Now, more and more chemical plants are being built on the north and south flanks of T'ien Shan. Up to September of this year, 67 chemical plants or units have already been built, including ten 400-ton contact sulfuric acid plants, and more than ten natural soda to caustic soda plants. Products already produced or successfully made on a trial basis number more than 50 types, and workers in chemical production increased from 300 a year ago to more than 30,000 at present. During January-September 1959, 900 metric tons of sulfuric acid, 440 tons of caustic soda, 15,000 tons of phosphate ore, 39,000 tons of Glauber's salt, 5,658 tons of sodium nitrate, and 134 tons of potassium nitrate were produced. In addition, during last winter and this spring, more than 400,000 metric tons of natural soda were excavated, and some has been shipped out to

assist other areas. By the end of this year, many more chemical enterprises will have been brought into operations.

Contests are held among advanced units and costs for producing contact sulfuric acid are steadily declining.

Shantung--As a result of the policy of walking on two legs, the chemical industry of Shantung Province has made great progress. As of the end of August, several hundred small scale chemical plants have already been established in the province and the following annual capacities are in existence: sulfuric acid, 12,600 metric tons; hydrochloric acid, 4,760 tons; and soda ash, 9,700 tons. Actual production during the first eight months of this year are: sulfuric acid, 1,357 metric tons; hydrochloric acid, 879 tons; soda ash, 676 tons, and sulfur, 6,295 tons. These products are partly meeting the urgent needs in the province.

As a result of improving techniques, modifying tools and equipment, reorganizing labor assignment, and strengthening management, the output levels for the province's small native group chemical plants have steadily risen and many advanced high production units are also producing high quality products. For example, for the Tsi-nan Yu-hsing 400-ton Contact Sulfuric Acid Plant, daily output is normally maintained at above 1.2 tons, conversion rate is stabilized at more than 90%, catalyst is used for more than 12 days before cleaning, and production cost per ton of equivalent 98% sulfuric acid has been reduced to 250 yuan. Another example is the Fu-tsin Chemical Plant's Leblanc process of making soda ash; quality has been quickly improved and the content of sodium carbonate is usually 80% (will try to raise it to 90% in the fourth quarter). The daily production rate of the 80-ton per year tower type sulfuric acid plant has been stabilized at 600-650 kilograms.

Chemical plants effectively help industrial and agricultural production, soon many small synthetic ammonia plants will be built.

Anhwei--Prior to 1958, aside from a few small hand method agricultural chemical plants established by consolidating some simple equipment transferred from Shanghai, the province practically had no chemical industry.

Many plants were developed during the leap forward year of 1958. Now there are 121 chemical plants, excluding small native fertilizer and agricultural chemical plants established by communes. Development of the small native group of chemical plants has been very helpful to the area's agricultural and industrial production. For example, the 69 tons of barium sulfide and glue type sulfur produced were very effective in preventing the wheat from getting the "rust sickness."

In the field of basic chemicals, the number of "sets" of small scale sulfuric acid plants either completed or being constructed total 45 with 7 already in normal production. Take the example of the Wu-hu Lien-meng Chemical Plant since the time its five units of small contact sulfuric acid came into production--each furnace produces 1.44 tons of 92% plus acid per day, the supply of which has greatly relieved a sulfuric acid shortage in the province. A hydrochloric acid plant using alum and salt as a raw material has been brought into production in the An-ch'ing Special District. A 100-ton per year furfural plant has entered production at Pang-fu City, and four more units will be added by year's end. As for small scale modern method carbide plants, one has been completed and another is being built; more than 400 tons of carbide have already been produced.

To further assist agriculture, two calcium-magnesium phosphate fertilizer blast furnaces, each of 10,000-ton per annum capacity, have already been built. The Wu-hu Tung-fang Iron Smelting Plant, in using 8-cubic meter blast furnaces, has successfully produced on a trial basis a maximum daily rate of 26 tons of calcium-magnesium phosphate fertilizer. At present, a small synthetic ammonia plant has already been built and several tens of additional plants are planned.

Chemical plant construction has been expanded on the principle of utilizing local materials.

Kiangsi--In the past, Kiangsi, Province practically produced no chemical raw materials. However, since the leap forward of 1958 when the small native group and small modern group movement got underway, much progress has been made and now several tens of different kinds of chemical products can be produced, including sulfuric acid, soda ash, carbide, sodium acetate, phosphate fertilizer, potassium fertilizer, coal tar, acetone, etc. Not only do the cities have chemical industries, but villages and communes also have native fertilizer, native insecticide, agricultural by-products, wild vegetation, and local mineral utilization type of chemical plants to serve agriculture.

According to incomplete statistics, the following plants have been established in Kiangsi Province: 28 "sets" of small sulfuric acid plants (twelve 80-ton per year tower type units and sixteen 400-ton per year contact type units); three 1,000-2,000-ton per year ammonia-soda method small soda ash plants; ten 100-1,000-ton calcium-potassium mixed fertilizer plants; five 10,000-ton per year calcium-magnesium phosphate fertilizer plants; three terramycin plants, and many widely scattered charcoal kilns which recover acetate of lime. In addition, there are two pilot plants for producing furfural. At the Hsiu-sui Hsien "San-tu-t'ai-yang-sheng" people's commune, 26 kinds of chemical products have been successfully made on a trial basis including acetate of lime, sulfur, potassium nitrate, chemical fertilizer, insecticide,

etc.; the yearly value of products total more than 500,000 yuan or about 30% the value of the commune's agricultural output. There are in the province 20-odd hsien-constructed fairly large integrated chemical and fertilizer plants. Consuming groups have also developed some chemical plants; for example small electrolysis plants have been built by paper plants, and soda plants have been developed by textile plants.

The development of the small native group and small modern group movement in the chemical field has also promoted progress in other fields. For example, at Yi-ch'un, Hsin-yu, Ching-teh-chen, etc., ceramic facilities and materials such as sulfuric acid containers, ceramic towers, magnetic rings, and screening plates can now be made. To solve the raw material problems of sulfuric acid, potassium fertilizers, etc., teams have been organized in many places to go up to the mountains to find ores so that many mines could be developed. Potassium feldspar in Tzu-hsi, An-fu, and An-yi; pyrite from Hsiu-sui, P'ing-hsiang, and Yao-li; and barite from Lin-ch'uan, Tung-hsiang, and Hsin-feng have all been extracted and used.

Walking on two legs provides great speed in completing small projects.

Kweichow--The province formerly had no large modern, small modern, or small native chemical plants. Much has since been accomplished under the Party main line and the "two-legged" policy.

The following are among the chemical enterprises completed during 1959: 25 small contact sulfuric acid plants, one 4,000-ton tower type sulfuric acid plant, one 1,400-ton carbide plant, one 450-ton potassium hydroxide plant, one small 140-ton caustic soda plant, and many small plants producing ordinary superphosphate, ethylene glycol, acetone, methyl ethyl carbinol, and phenol and aldehyde plastics.

The estimate for this year's total chemical output value is 180,000,000 yuan or 50% greater than in 1958. Many products formerly not made are now produced. The province can produce 2,500 metric tons of sulfuric acid this year, which should meet the basic needs of the province. Now that potassium hydroxide is produced, a new way has been opened to supply the raw materials required for potassium permanganate production.

5. Technical Demonstration Contests at the Dairen Chemical Plant

Pages 21 & 43 (excerpts) Lo Chi-ch'ang and others

Technical demonstration contests are taking hold at the Dairen Chemical Plant. This movement was started as a result of copying the advanced experience of the Anshan No. 3 Steel Plant. All groups are competing, and a new phenomenon has been developed at the plant. Through this movement, output for six main products at the plant during the second ten days of October all surpassed targets. According to present performance conditions, the over-all production for this plant will attain the year's target 21 days ahead of schedule.

In the beginning, some people felt that technical contests cannot be carried out in chemical production. The doubts were refuted by facts within a few days. There is no question that successful contests can be started. The method is to conclude from experience, find out characteristics, and search for a solution. Examples below will describe the circumstances.

With regard to the "high-pressure hammer of the vertical nitrate section" in the ammonium nitrate unit, Mr. Sung Lien-shan in carrying out the first technical demonstration reduced the reaction time for the "high-pressure hammer" by 12 minutes and, as a consequence, established a new production record. This record soon was broken during the second technical demonstration by Mr. Wang Tien-ch'in. Such contest within the section quickly created the enthusiasm for learning and mastering advanced techniques so that the operational level for each comrade was steadily raised. At present, daily output of concentrated nitrate has been brought up to about 10% more than before the contests and product quality has become stabilized at a grade better than 98.5%.

Contests in the synthetic ammonia and ammonia sulfate units followed. On the basis of contests among individuals and work items and according to production characteristics, cooperative contests were initiated in all phases of work with the result that production leaped and leaped again. For the synthetic ammonia unit, even under the condition that one less 1500-HP compressor is used, daily output records have been established and product quality raised from 98.5% to 99.3%. For the ammonia sulfate unit, daily output rate for tower acid and contact acid have been raised 11.45% and 11.85%, respectively. In the contests for the nitrate salt unit of the ammonium nitrate unit, through finding quicker methods of conversion and the trick of controlling temperature, the daily output rate for sodium nitrate has been raised from 25 metric tons to 32 tons.

6. Our Plant's Native-Method Contact Sulfuric Acid Production

Pages 25-29 (excerpts) Wu-hsi City Oil Refining Plant

A. General Conditions

Our plant's principal product is oil, hence large quantities of concentrated sulfuric acid are needed. As production developed, it was decided to construct a 400-ton per annum native-method contact sulfuric acid plant to solve in part the difficulties caused by the shortage of raw materials. In January of this year, we started to build a 400-ton sulfuric acid plant according to blue prints supplied by the Hua-tung East China Design Branch Institute. Basic construction was completed in the last ten days of February, and the plant was brought into production by the beginning of March. For lack of experience, we could not make the plant run on a smooth basis; daily production was only 400-500 chin, ore consumption was high, product quality was unstable, much stoppage of work resulted, and the plant was only worked for about 15 days per month. At the time, some people lost faith in the native-method contact sulfuric acid plant; some cadres even began to doubt the wisdom of the Party's policy on developing small native group plants. As a result of the movement to combat rightist thinking, to work hard and learn, and to strive for higher production and lower costs through overcoming superstitions and liberating thought, technical research groups were organized in July under the leadership of the city's industrial bureau, and representatives were dispatched to the Shanghai T'ien-hsing Chemical Plant to observe a similar plant in operation. Through the experience gained and the support of the Party, we located the weak points of the operations--unbalanced condition of the equipment, "excessive resistance of the system," and inadequate absorption--and made a series of changes on the cooling pipes, absorption tower, converter, etc. Ever since continuous production was started on 19 August, production has steadily risen. During September, daily production reached 1,640 kilograms; and by mid-October, the rate was raised to 1,835 kilograms. The concentration of the sulfuric acid was stabilized at 65-66 degrees (Baume). Nearly one-third of the acid was of the "smoking type," and production quality in general had reached design levels. Simultaneously pyrite consumption was reduced and costs greatly lowered. The new turn of events gave the workers much confidence and everybody feels that the native method of making sulfuric acid by the contact method can be successfully operated. Equipment and operating conditions are briefly described below.

B. Techniques and Design Items

The principal equipment and specifications are shown in Table I.

Table I

1 lump ore furnace: furnace hearth area 70x70 mm, 6 sections, total area 2.94 square meters.
1 converter: diameter 1.24 meters, height 1.4 meters, 0.16 m^3 vanadium catalyst placed in first section or layer and 0.14 m^3 in the second layer.
2 absorbers: diameter 45 mm and 50 mm, both 4 meters high filled to 3.5 meters.
5 cooling tubes for sulfur trioxide: 15-meter length of 8" cast iron pipes.
3 cycling acid cooling tubes: 6-meter length 2" black iron pipes.
2 foam-elimination towers: one each of 50 mm and 40 mm diameter, both 4 meters high, filling magnetic rings.
1 coke tower: diameter 45 mm, height 2 meters, charged with coke.
1 blowing machine: ordinary type, 2.8 kw, 1,500 rpm.
1 acid pump: ordinary water pump (cast iron gears), 2.8 kw.

C. Comparison of Various Economic Indices Before and After Modifications

Table II

Item	Before Modifications	After Modifications
Daily output	500 kilograms	1,400-1,500 kilograms
Sulfuric acid concentration	Unstable	65-66° Baume, plus 1/3 fuming acid
Ore consumption	About 3 tons of ore per metric ton of 98% sulfuric acid	1.69 tons of ore per ton of acid
Production cost	732.81 yuan per metric ton of sulfuric acid (98%)	237.35 yuan per metric ton of 98% sulfuric acid
Days of continuous production	15	More than 28

D. Labor Organization and Safety Aspects

1. Plant personnel and division of labor--each day there are three shifts, and each shift has 4 persons (including rotating rest day), including 2 furnace operators, one man for analyzing acid and gas, and one man for odd-end work. There are 12 persons all told in three shifts plus a section chief in charge or 13 persons altogether.

2. Major points on safety

(1) During operations each person should, according to the requirements of the job, have equipment like glasses, rubber gloves, acid-resistant clothes and boots, etc., for preventing corrosion by acid and assure safety.

(2) When sulfuric acid spills on the skin, use large amounts of water to wash. When the condition is severe, send the victim immediately to the infirmacy for treatment.

(3) In all the working areas of the plant, clean water and lime should be placed at various places.

(4) The sulfuric acid produced during each shift should be placed in jugs and immediately sealed and covered with tile to keep rain water out.

E. Important Aspects of Operations

Intake temperature of the first layer converter	440-460° C
Outflow temperature of the second layer converter	500-560° C
Intake temperature of the absorption tower	less than 140° C
Temperature of cycling acid	less than 45° C
Concentration of cycling acid	98.3% (65-66° Baume)
Outflow pressure of the second layer converter	10-20 mm mercury
Draft pressure of absorption tower	20 mm mercury column
Blower pressure	80-90 mm mercury
SO_2 concentration in furnace gases	5-7%
SO_2 concentration in end gas	0.4-0.6%
Converting ratio or rate	90-95%
Roasting intensity	800-750 kilograms/ m^2 . day (ore)
Sulfur content of pyrite	about 30%
Water content of pyrite	less than 2%
Sulfur in cinder	less than 4% (sometimes 5.6%)

Production Cost

During September, 40.03 metric tons of sulfuric acid were produced at a total cost of 9,494.94 yuan, or 237.35 yuan per metric ton. Calculations are listed in Table 3.

There are many aspects that must still be improved in our operations, particularly with regard to analytical work. Much credit for what has already been accomplished must be given to the Party's leadership and support. We will certainly continue to learn from the experiences of "brother units" and further improve our operations.

Table III

Item	Quantity	Unit Price (yuan)	Total Sum (yuan)
Pyrite	67,975 kilograms	0.1015	6,899.46
Vanadium catalyst	---	---	30,000
Fuel	2,000 kilograms	0.035	70
Electric power	3,226 kwh (or 115.2 kwh per day)	0.115	290.34
Manpower	9.33 persons	5.77	538.70
Auxiliary wages	538.70	15%	80.80
Plant expenditure	261 man-shifts	3.45	900.45
Management of enterprise cost	4.25% of plant cost	---	385.89
Plant cost	---	---	9,465.64
Marketing charge	0.3% of the plant cost		28.40
Total cost			9,494.04

Note: 1. Pyrite cost calculated at 101.5 yuan per metric ton. If this raw material were cheaper, total cost would be correspondingly lower.

2. Cost includes wages for hand breaking of ore.

3. Vanadium catalyst consumption has not been carefully calculated. Tentatively, the estimate is the use of 0.3 m^3 in 6 months.

7. Success in Experimental Production For a 4,000-Ton Per Year Contact Process Sulfuric Acid Plant

Pages 31-33 (excerpts) .... Ting Fang

Our country's first 4,000-ton per year water washing contact sulfuric acid plant with a new flowsheet has been successfully tried out and, in fact, brought into production by the Shanghai Chemical Research Institute No. 1 Research Plant (Station). Development of this new technique is a victory of the technical revolution and efforts of the masses under the leadership of the Party.

During the over-all leap forward of 1958, the production of sulfuric acid, a basic raw material of the chemical industry, occupied the front line in the leap forward of the chemical industry. Sulfuric acid was in great demand, particularly by the chemical fertilizer industry. In line with directives from above, our institute decided to make pilot plant tests on a new flowsheet related to a 4,000-ton per year water washing contact sulfuric acid plant, first of all to prove that the new flowsheet is workable and secondly, to produce sulfuric acid to meet part of the needs for research in other special projects. Raw material, equipment, and manpower shortage problems were overcome by the hard work, ingenuity, and enthusiasm of the entire working force. With the help of related units, the steel material and principal equipment supply problems were quickly solved. Our machine shop plunged into equipment manufacture and installation work. Basic construction was completed by early September of last year, after being initiated in mid-July. While construction was in progress, we sent 10-odd young workers to learn from "brother" plants. Many operational difficulties were subsequently encountered because our workers had no previous experience in this line. After a year's struggle, production became normalized and the technical and economic barriers confronting this 4,000-ton contact sulfuric acid plant finally were surmounted. Daily production has become stabilized at more than 11 metric tons per day. The new water washing contact sulfuric acid flowsheet will be of great significance in the efforts of our country's sulfuric acid industry to achieve the Second Five-Year Plan goals three years ahead of schedule.

IV. ARTICLE FROM SUPPLEMENTARY ISSUE, 9 NOVEMBER 1959

1. The Rear Wave Pushes the Forward Wave, Leap Forward and Again Leap Forward

Pages 25-26 (excerpts) Unsigned article

The Shanghai T'ien-yuan Chemical Plant is an integrated basic chemical type of chemical plant, which produces caustic soda, liquid chlorine, hydrochloric acid, oxygen gas, and other products totaling more than ten types. These products furnish the needs of more than 1,000 customers in Shanghai and elsewhere in the country--metallurgical, machinery, chemical, textile, light industry, "public" and commune enterprises. Since the liberation, the T'ien-yuan plant, under the correct leadership of the Party and fully developing the capabilities of the masses, has established a series of "socialist production management normal operating schedules" which have resulted in great increases in production. Much technical revolution and improvement took place under the glorious rectification movement when the red flag of the main line was raised high. For example, the vertical type adsorption diaphragm electrolytic cells (T'ien-yuan model 12 and model 16) successfully made on a trial basis enabled the use of the internationally advanced Lieh-wen evaporator in the caustic soda industry and thus opened the way for a new technique in the making of caustic soda by the electrolysis method. The hydrogen gas automatic pressure control equipment, also successfully made on a trial basis, will solve the long unsolved problem of safe production in electrolysis techniques. In the field of basic construction, a three-year quota was met in the single year of 1958. Large quantities of caustic soda and other products are now produced at an earlier date to meet the country's needs. The T'ien-yuan plant made an unparalleled leap forward in 1958, producing in value 50 times more than the rate just after the liberation. This plant during 1957 was three-times proclaimed as an advanced plant in the national contests held on salt electrolysis and, during 1959, was also among the advanced units in Shanghai with regard to the production of chemical raw materials.

Beginning in 1959, the staff and workmen were intent on making even greater advances in production, despite various difficulties in raw material supply and in the unbalanced condition of equipment capacities. By August 9th, or 221 days from the start of the year, the production of caustic soda had already equalled the total for the leap forward year of 1958. The tonnage and value of the past nine months production were both one-and-a-half times greater than the corresponding period of last year, with caustic soda output already 78.5% of the 1959 quota and hydrochloric acid, 90%. The chlorosulfonic acid and polyvinyl chloride units constructed this year were also brought into production in August and September respectively; product

quality for these units are meeting specifications. During January-August, as compared with last year's assigned average, savings in electricity was 1,280,000 kwh (tu) and savings in coal was 970 metric tons. All these achievements did not just happen.

The Party organization greatly supported the opinions of the workmen. In the case of the iron hydrochloric acid furnace, through measures adopted as a result of workers' suggestions, daily capacity was raised from the designed level of 30 metric tons to 50 tons. The movement to consult the workmen at the T'ien-yuan plant thus got underway.

Calculations showed that the way to greater production lies in raising electric current. However, obtaining more electricity from the electric companies is difficult. It was necessary to reduce voltage of the cells, strive to increase the number of electrolytic cells, and open more current to increase production and save electricity; this approach conforms with the principle of "more, fast, good, and economical."

After the workmen at the T'ien-yuan plant clearly understood the fighting targets, action was taken along the following two lines: on the one hand, improvements were made in operational management and maintenance and inspection of the cells (to eliminate cells emiting high hydrogen in the chlorine and those with high voltage and repair cells as quickly as possible--70 cells were repaired in 14 days of March); on the other hand, old stone electrolytic cells were fully utilized and gradually replaced by the T'ien-yuan model cells to develop a second cell system for increasing production. These were the methods used to raise production above designed levels in the case of the electrolytic cells; progress in other lines was similar. Production of "electrolysis dilute alkali solution" was gradually raised from 80 tons in the early part of the year to 90 tons, 94 tons, and finally the record of 101 tons at the end of September.

V. ARTICLES FROM ISSUE NO. 22, 21 NOVEMBER 1959

1. Report on Pushing the Development of Small Synthetic Ammonia Plants

Pages 4-6

Work Team on Problems Relating to the Construction of Small Synthetic Ammonia Plants

Editorial note: The Work Team on Problems Relating to the Construction of Small Synthetic Ammonia Plants has been formed according to the directives of vice premiers Li Fu-ch'un, Po I-po, and Nieh Jung-chen, and includes State Committee members from the scientific, economic, construction, and design fields plus representatives from the ministries of agriculture, chemical industry, and No. 1 machinery industry. The Work Team during 8 to 14 October inspected the 800-metric ton per year small synthetic ammonia plant of the Dairen Chemical Plant, the plants which make the whole line of equipment for small synthetic ammonia plants, communes using liquid ammonia as fertilizer, agricultural research stations, etc., and exchanged opinions. This is a brief report to vice premiers Li, Po, and Nieh. The report contains specific recommendations regarding the policy of constructing small synthetic ammonia plants and concrete measures to be taken. It should be studied by all related organizations.

A. Conditions Have Ripened for Widespread Construction of Small Synthetic Ammonia Plants

The Dairen Chemical Plant's 800-ton per year unit for making synthetic ammonia, successfully built on the basis of a previous 400-ton unit, is a model small synthetic ammonia plant. We agree with the Scientific Committee's basic arguments favoring small synthetic ammonia plants. These plants are easy to build, equipment simple to make, construction conditions are not severe, construction time short, investment low, steel requirements small, and costs are in line. They can play an important part in providing chemical fertilizers to meet the urgent needs of agriculture.

Equipment for these small plants are much easier to make and assign compared with large plants. With regard to the equipment for 35 small synthetic ammonia units programmed for this year by the Ministry of Chemical Industry, aside from part of the high-pressure equipment being assigned to the Chin-hsi Chemical Machinery Plant for manufacture (actually Lu-shun and Dairen can make them too), all requirements are essentially met by Lu-shun and Dairen Cities. Therefore, many provinces and cities can solve their own equipment problems and the three difficult-to-make pieces of equipment (compressor, synthesis chamber, and "copper solution" pump) can be made on a cooperative basis.

At the same time, because of the small requirements for raw materials (coke, coal, water, and electricity), supply problems are easy to handle--materials can be obtained locally, necessitating little transport. Thus, favorable conditions exist for pushing the development of the small synthetic ammonia plants.

To design and construct an 800-ton per annum small synthetic ammonia plant, 819,000 yuan in investment and 198 metric tons of steel materials would theoretically be required. In actual practice, another 20-30% in investment and materials would be needed. Even at this latter rate, however, the unit charges and materials are about the same as for large plants. Construction time for small plants are, of course, much less-usually a year or two less. If equipment can be lined up, only 4-6 months is needed to build small plants, according to the experience of the Dairen Chemical Plant. Experience in constructing 400-ton synthetic ammonia plants in Anhwei Province shows that construction time can be further reduced.

According to the present operating conditions for small plants, production cost for making synthetic ammonia in the early stages are a little higher than the designed cost of 454 yuan/metric ton and considerably higher than the production cost of 180-200 yuan/ton for large plants. However, costs for further processing into aqua ammonia and ammonium sulfate is about the same for both the large and small plants. Although the cost of applying aqua ammonia involves extra charges, money and materials (steel and sulfuric acid) would be saved by not further processing the product. Thus, although costs are higher for small plants, the use of the product for fertilizer on the basis of equivalent nitrogen means that the actual over-all cost may not really by high. Besides, small plant operations can be further improved. If the quality of equipment manufacture and installation is good, if workmen have mastered production techniques, special attention is given to maintenance and repair, if leakage and other obstacles are minimized, and if the latent capacity of the equipment is fully utilized, yearly production for small plants can reach 1,000 metric tons of synthetic ammonia. There are also aspects in design which can be further improved. With regard to raw materials, if anthracite and other fuels can be substituted for coke, costs can be reduced.

B. Preliminary Experience Gained in Application of Aqua Ammonia

The above analysis shows that the small 800-ton per year synthetic ammonia plant has passed its test both from the economic and technical angles and should be pushed as a model design plant. However, the ultimate success of building many such plants will depend upon solving the application problems of aqua ammonia. The material is a liquid fertilizer volatile and corrosive in nature and with a strong smell; it is fiddicult to store and transport and, if allowed to volatilize,

means not only losses in effectiveness as a fertilizer but also danger to the people handling it. Present experience shows that the "bud burning phenomena" is mainly caused by the volatilization of the liquid or aqua ammonia. Thus, a whole series of problems related to transport, storage, application methods and tools are developed. Judging from the results at the Hopeh Province State-owned Lu-T'ai Agricultural Station and the Lu-shun and Dairen area (a total of more than 5,000 metric tons of aqua ammonia have been used in two years, there being much failure last year and total success this year), we have already achieved preliminary success. If we can draw appropriate conclusions from experiments conducted in many lines, there seems to be great hope in more efficient application of aqua ammonia.

Regarding the effectiveness of this kind of fertilizer, our experience in many types of crops such as rice, corn, fruits, vegetables, etc. shows that as long as methods are suitable, aqua ammonia is as effective as ammonium sulfate on an equivalent nitrogen basis and that there is no "bud burning phenomenon" so that the farmers welcome liquid ammonia. For example, for Hsin-chin Hsien during a great drought this year, aqua ammonia was applied in an area of 40,000 mou of farmland for the purpose of not only adding fertilizer but also resisting drought; about 40-50 chin of liquid ammonia was applied on each mou of land, which ultimately yielded 90 chin per mou additional corn--the farmers called it the "life saver water" and "increase production water." Aqua ammonia, when applied to farmland, also has the effect of killing insects and preventing plant diseases.

With regard to fertilizer application tools, the Lu-Ta Shui-shih-ying People's Commune developed the open ditch type of fertilizing implement and the 30 li-pu" People's Commune developed the injection method fertilizer application implement. These and other implements for applying aqua ammonia are simple, light, effective, and easy to make and use on a large scale.

Loading, unloading, and transport of liquid ammonia are fairly bothersome. However, the common method used by the farmers in Lu-ta--manure carts for transporting aqua ammonia--has been fairly satisfactory. To prevent losses in leakage, they soak and expand the wooden tubs or put on tung oil or bitumen (also good from the viewpoint of preventing corrosion). In loading and unloading, they use the sealing, siphoning, and other methods which are also fairly effective.

For storage, they use the acid container, the liquor container, the especially painted container, the tile container, and stone-built containers. Although there are still some leakages, special efforts in sealing and prevention of volatilization will minimize the problem.

There are many methods to prevent the volatilization of ammonia. We know the following: add some CO_2 waste gas derived from ammonia

manufacture to the liquid ammonia so that it becomes a saturated solution of ammonium carbonate which is less volatile; add some vegetable oil or foaming material on the surface of the liquid ammonia to minimize volatilization. The Coal Research Laboratory of the Academia Sinica is currently conducting experiments in using coal slime to absorb aqua ammonia, and ammonia gas, and to make the humic acid contained therein to react with the ammonia to form difficult-to-volatilize ammonia-humic acid combination material; results have been good and stability is achieved when coal slime absorbs 3-6% of the ammonia. It is felt that (coal) settling tank mud, lignite, and coaly shale will also be suitable in absorbing ammonia. Experiments conducted at the Lu-ta Agricultural Research Station on using kaolin to absorb ammonia has also been successful. The Dairen Chemical Research Institute Branch Institute is making experiments on preventing corrosion by aqua ammonia. In addition, in areas where there are waste sulfuric acid solutions and chloride solutions, it is possible to combine these with ammonia to make ammonium sulfate or ammonium chloride; in other areas where there is alumstone, potassium-nitrogen combination fertilizers can be made with liquid ammonia to prevent volatilization.

It is therefore seen that successful experiments have already been made in solving the problems of storage and transport. As long as we continue to work hard, stir up the masses to greater efforts, improve on our present operations, carry out more and larger scale experiments, and adopt native-modern combination and construct according to local conditions methods, the application problems related to liquid ammonia should be solved. The experience of Lu-ta shows that as long as the masses realize that liquid ammonia can raise production, methods can be found to apply it and too much worrying is unnecessary.

Thus, further processing of ammonia should be primarily in the direction of making aqua ammonia. This is the correct approach since the world's industrially advanced countries are also moving toward more application of liquid ammonia. By the same token, we should try to spread the construction of the small800-ton per year synthetic ammonia plant. As for further processing of ammonia into other products like ammonium sulfate, ammonium chloride, ammonium nitrate, and ammonium bicarbonate, the Ministry of Chemical Industry also has definite plans to fit into local conditions and meet specified demand.

C. Some Recommendations

The Dairen Small Synthetic Ammonia Plant on-the-spot conference and the successful application of aqua ammonia in the Lu-ta area clearly show that, on the premise that industry should greatly help agriculture, there will be rising tide of development of small synthetic ammonia plants and increasing use of liquid ammonia. Plans have already been made on the national and local levels to emphasize these small synthetic ammonia plants. We recommend that the following types of work be emphasized

1. Equipment manufacture and production preparations.

a. In order to solve the supply problem with regard to equipment, work done on provincial and city levels on the premise of building up strength from within should be emphasized. However, for special large and complicated pieces of equipment such as synthesis chambers, compressors, "copper solution" pumps, meters and gauges, etc., there should be a national plan to provide them so as to expedite over-all construction of synthetic ammonia plants. A dual emphasis is therefore in order.

b. Most of the steel materials needed for equipment manufacture and installation can be provided domestically. However, some materials such as No. 10 low-carbon steel plate, very hard and tough alloy steel materials, and small diameter cold drawn seamless tubes and pipes are only made in small quantities domestically. Therefore, as the small synthetic ammonia plant program is pushed, we should pay particular attention to material allocation and be prepared to import some items if necessary.

c. With regard to technicians needed to construct, install, and operate these plants, the Ministry of Chemical Industry, and various provinces and cities have already made some preparations. Particular emphasis should be placed on on-the-spot training. In addition, the Ministry of Chemical Industry has decided to organize a "start work corps" to assist various provinces and cities in establishing model plants; the provinces and cities should do similar work.

d. At present the raw material used is still metallurgical coke, which would not be a satisfactory situation for all areas. The Ministry of Chemical Industry has already made successful experiments on the use of anthracite and medium-temperature coke (char) to substitute for coke. More should be done in this line. By the end of this year, formal reports will be published on the use of native coke, semi-coke, anthracite, and other coal and coal derivatives so that the method to be used can be selected on the basis of local raw materials.

2. Application of aqua ammonia

Mass efforts should be utilized to overcome the technical barriers related to the application of aqua ammonia. More experiments should be made, model methods should be demonstrated, and more on-the-spot conferences should be organized so that the masses will be more interested and learn enough to make further innovations. We recommend the following action:

a. For the various units in Lu-ta and the Lu-t'ai Agricultural Station, which have already considerable experience in the application

of liquid ammonia, we recommend that they make further investigations in the utilization, storage, and transport of this type of fertilizer and come up with further conclusions this winter or next spring.

b. We recommend that the Ministries of Agriculture, Agricultural Cultivation, Agricultural Machinery, and Chemical Industry jointly call more on-the-spot conferences with corresponding provincial and city units and research organizations with regard to application of liquid ammonia, and establish testing areas (liquid ammonia to be supplied by local plants) for ammonia utilization, storage, and transport in cities and areas such as Nanking, Kirin, Lanchow, Peiping, Shanghai, T'ai-yuan, Ho-fei, etc. We require that by this winter, next spring, or at the latest the end of next summer, that problems of utilization, storage, and transport of liquid ammonia be basically solved to prepare the way for a rapid development of small scale synthetic ammonia plants.

2. Briefly Introducing the 800-Ton Per Year Synthetic Ammonia Plant

Pages 8-11 (excerpts) Unsigned article

To accelerate the development of the chemical fertilizer industry and better assist agricultural expansion, the Dairen Chemical Plant on the foundation of adding more than one year of experience to a 400-ton per year synthetic ammonia plant already built designed a 800-ton per year synthetic ammonia plant. Construction of the 800-ton plant can be made in two stages: the first stage involves the building of a 400-ton plant; and the second stage, through adding only fair amounts of equipment, expansion of the initial unit into a 800-ton plant.

Table 1. Principal Equipment

2 (1 spare) air blowers—2,000 m^3 per hour capacity and 800 mm pressure.

4 (1 spare) coal gasifiers—internal diameter 700 mm and gas capacity of 160 "standard" m^3 per hour.

1 scrubbing tower—800 mm in diameter, materials charging height, 3,750 mm, area 138 m^2.

1 semi coal water gas producer—volume is 150 m^3.

1 saturated hot water tower—saturating tower ⌀ 720 x 8 mm, height 6,875 mm, charging is 25 x 25 x 3 porcelain rings, heat conducting area 117.5 m^2; hot water tower ⌀ 720 x 8 mm, height 4,830 mm, charging is 25 x 25 x 3 porcelain rings, and heat conducting area is 224 m^2.

1 heat exchanger—⌀ 529 x 6 mm, height 4,500 mm, each part ⌀ 18 x 2 x 3,710 mm seamless tubes 241 units, each part heat conducting area is 44.5 m^2.

1 converter—⌀ 1,200 x 8 mm, height 3,810 mm.

3 gas compressors—electric power driver 5-stage vertical type, first-stage intake volume is 270 "standard" m3 per hour, and fifth-stage outflow pressure is 120 atmospheres.

1 water washing tower—⌀ 1,000 mm, gas handled per hour is 540 m^3 (calculated on basis of consumption of 5,020 standard cubic meters of raw material gas per ton of ammonia).

2 copper washing towers—outside diameter 159 mm and inside diameter 123 mm seamless tubes, 177 standard m^3 of gases handled per hour (calculated on basis of consumption of 5,020 standard cubic meters of raw material gas per ton of ammonia).

[Table continued on page 90]

1 soda washing tower--outside diameter 159 mm and inside diameter 123 mm seamless tubes, 400 standard m^3 of gases handled per hour.

1 synthesis tower--inside diameter 450 mm, height 4,300 mm, catalyst 0.23 m^3.

1 ammonia separator-oil separator (in two parts)--outside diameter 159 mm and inside diameter 123 mm seamless tubes, chamber filled with 300 mm section.

1 water cooler--heat conducting area is 135 mm.

2 cool air exchangers--built with 159 mm outside diameter and 123 mm diameter pipes.

1 ammonia absorption tower-- ∅400 mm, height about 10 meters, 0.62 m^3 porcelain rings.

Table 2. Some Basic Materials Needed to Build an 800-Ton Synthetic Ammonia Plant

Item	Fixed-Type Equipment	Non Fixed-Type Equipment	Installation Requirements	Total
Iron and steel (m. tons)	56	53.73	88.73	198.46
Wood materials (m^3)		10.6	45.8	56.4
Cement (m. tons)			117.5	117.5

Note: This table includes materials needed for machinery repair, boiler, cycling water system, liquid ammonia manufacture, and utensils for holding the aqua ammonia.
Steel materials needs would be less if water does not have to be recycled, no boiler needs to be constructed, and containers for holding the liquid ammonia are already available.

Table 3. Raw Material Consumption According to Basic Design

Coking coal (fixed carbon less than 80%)--1.95 tons per ton of liquid ammonia.

Steam--9.7 tons per ton of liquid ammonia.
Electricity--2,600 kwh per metric ton of liquid ammonia (if aqua ammonia is made, add 10 kwh per metric ton).
Water--1,110 metric tons per ton of liquid ammonia (if aqua ammonia is made, add 140 metric tons of water).

3. Increase Production, Practice Economy, Solve the Dilemma In the Supply and Demand of Chemical Products

Pages 17-19 Vice Minister Wu Liang-p'ing

This conference deals with production and supply of chemical products. The objective is to make arrangements and assign quotas for the first half of next year with particular emphasis on the first quarter. We are still deliberating and have not made the final decisions with regard to the plans for production and construction in 1960. This preliminary meeting should help develop the plans.

A. The Overall Situation of Chemical Production in Coming Year

Prospects for next year are good in the chemical industry. Last year was the great leap forward, this year we have made further rapid gains, and next year should be a continued leap forward.

We must realize, however, that the chemical industry is still a weak sector of our country's economy. The chemical base left by old China was extremely weak; and the demand for chemical products has risen very rapidly. Therefore, despite the rapid progress in chemical production during the last few years, requirements by industry and civilian use cannot be met. The shortage is accentuated by the government's decision to assist rubber plants and also to help agriculture to meet the greater demand for chemical fertilizers, chemical insecticides, etc. Requirements for chemical products by the heavy and light industries have also risen greatly.

Since the chemical industry is a weak sector, we must strive to have it catch up with other secotrs. We are making progress, but so are the other sectors. Therefore, we must move still faster. Of course, it is difficult to catch up in a year since definite stages of development are necessary. How can we catch up?

First of all, we must catch up in steps. Funds and equipment are somewhat limited in the coming year. Since one of the main objectives in chemical development is to assist agriculture, it is necessary to emphasize the chemical products used in agriculture, such as chemical fertilizers and chemical insecticides. At the same time, to satisfy the farm equipment and transport needs, as well as general industrial and transport needs, in car tires, bicycle tires, rubber tubing, rubber belts, etc., we must greatly expand the synthetic rubber industry. Next, to meet both agricultural and industrial needs, we must also continue to expand the basic chemical industries (acids, alkalies, inorganic salts, etc.), mines engaged in the production of chemical ores, and industries supplying organic chemical raw materials. Generally speaking, we should emphasize the development of chemical raw materials.

Borax is much in demand domestically and an important item of export; it is a product which we must place great emphasis on next year. All kinds of synthetic materials, including synthetic rubber noted above as well as plastics (includes insulating materials), synthetic cellulose or fiber, synthetic washing or scrubbing reagents, high-quality dyes, etc., are also chemical products in great demand. These products have an important bearing on changing the technical complexion of the country's economy and open up a second source of raw materials for light industries. We should establish a good technical base for these products during the coming year.

Secondly, we must carry out the government's two-legged policy of integrating large, medium, and small, with emphasis on medium and small. Of course, we must rapidly construct some absolutely essential large enterprises; but, to accelerate over-all development, we must employ all methods and stress medium and small enterprises. According to preliminary plans of the Ministry of Chemical Industry, about 40% of next year's investment will be in "small native and small modern groups" of chemical plants. We hope, within the limits of an over-all plan, to develop suitable model plants this winter, and by next year, to start on a national scale a mass type small native (modern) group movement in the chemical industry.

Thirdly, everybody must work together to develop the chemical industry. The metallurgical units require large quantities of chemical products and, in fact, produce many types, as for example benzene, naphthalene, and other coke by-products. The machinery and equipment units also need large amounts of chemical products, such as electrical insulating materials, carbide for welding, etc., some of which are produced by these units. The petroleum units are involved in many chemical products, carbon black being one of the items in immediate demand. The construction and light industry units also require many chemical products, particularly soda ash, caustic soda, etc., and hence be similarly involved in making chemical products. Recently the Yao (Yueh)-hua Glass Plant built a small soda ash plant which not only surmounted technical barriers but is also being considered as a model small soda ash plant for the nation. The light industry units are recovering by-product chemical materials, such as potassium chloride, bromine, iodine, methyl alcohol, glycerol, rosin, etc. to meet the needs of the chemical industry. Commercial units have been involved in the production of sulfur, native chemical fertilizers, native insecticides, etc. Even other types of units, such as forestry and grain departments, also require and produce chemical products. Through participation by all units, by various places, and by everyone, the chemical industry can quickly catch up.

B. Next Year's Supply and Demand Dilemma for Chemical Products

The great demand for chemical products by agriculture, light industry, heavy industry, and communications and transport industries cannot be fully met because there is a time gap in the supply. For many basic chemical products (particularly acids and alkalies) the production-demand difference will still be large, particularly during the first half of next year and more particularly the first quarter. The gap is even greater for organic chemical raw materials. Next year's production of chemical fertilizers will also be much less than the demand, agricultural needs being "the more the better." Next year's production of insecticides will also be lower than the demand suggested by the Ministry of Agriculture. Although final production figures for next year are still to be programmed, it is evident that demand will be considerably larger than supply.

C. How to Solve the Shortage Dilemma

To solve this dilemma, it is necessary to continue to combat rightist thinking, work hard, and push mass movements on raising production and making savings. In the first place, aside from making sure that this year's production quotas are fully met, the preparatory work for the output of the first quarter of next year should be done well so that this quarter's production is in all cases higher than this year's fourth quarter levels. At this juncture, we would like to mention two points. First of all, we are not saying that production quotas for all products and for all enterprises for the first quarter of next year be greater than the actual output during the fourth quarter of this year. To compensate for the seasonal nature of agricultural production, it is necessary to stress the production of chemical fertilizers and insecticides during next year's first quarter at the expense of other products, which in turn can be pushed in the second and later quarters so that over-all quotas can be attained. Secondly, the production of chemical raw materials cannot, at the moment, catch up with the needs in terms of further processed products. In some provinces and cities, the local suggested production quotas for chemical raw materials are smaller than those suggested by the Ministry of Chemical Industry; the reverse is true in the case of further processed products. We must think of more ways to raise the production of chemical raw materials, otherwise the needs for further processing will never be met. To increase production, we must emphasize the following aspects of work:

1. Basic construction projects must be more rapidly brought into production, especially "wind-up" work in the field of chemical raw materials. We should develop more medium and small enterprises which require low investment and can be completed quickly. Next, all provinces and cities should emphasize the development of mines and transport and raise them to positions of greater importance. The ores needed

by medium and small enterprises cannot be fully met by a few large mines for resource and transport reasons. It is essential to develop small mines where resources exist.

2. Production techniques must be emphasized. In recent years, improvement of techniques has been responsible for possibly half of the production. There is much potential in this regard.

3. Concentrate on the weak points. Among the chemical products, the current weak points are acids, alkalies, mine ores, pure benzene, phenol, etc. With regard to the supply of chemical ores, the problems are inadequate short-haul transport and product type (quality) not suitable in meeting demand. In operations, the weak points are storage and transport of products, transport within plants, supply of water, electricity, steam, equipment maintenance and repair, etc. Of course, there are also weak points in production flowsheets, such as better balance in equipment capacity. In addition, there is need to balance the quantities of related series of chemical raw materials. In summary, definite measures must be taken to overcome various weak points so that potential capacity can be fully utilized.

While emphasizing production increase, it is also necessary to stress economy. In the first place, savings in raw materials can be made on the basis of consumption quotas assigned according to advanced experience. Secondly, "do not use when not necessary to use, substitute when it is possible to do so." In actual practice, much potential savings are possible within prescribed chemical processes. Next, emphasis should be placed on integrated utilization. Finally, savings must be made in packaging materials and in recovery and re-use. For example, although things like the air valve of tire tubes and the bottle caps for penicillin are small, they are used in large quantities and require much copper or aluminum to make so that recovery and re-use are very important. Iron drums and canvas sacks must also be salvaged to relieve the shortage. Better organization and less waste are necessary in transport equipment and transport capability. Water, electricity and steam, etc. must also be conserved. Valuable experience along these lines have been accumulated in various places and the information should be disseminated to all interested parties.

Good allocation is necessary along with high production and economy. We have the following opinions:

1. First of all, assist agriculture. The policy should be to provide suitable and adequate products. Since agriculture is seasonal in nature, this characteristic should be recognized in supplying chemical products. For the first quarter of next year, emphasis should be placed on allocating and producing chemical fertilizers and insecticides.

2. Within limits, stress the coordinated supply of related products. We must do this well. However, to entirely solve this problem, we must also rely on building strength from within, with everybody thinking of methods. We must disseminate information on successful practices elsewhere.

3. Assignment of production must be coordinated with making available the necessary supplies (materials, equipment, funds, manpower, etc.). As production increases, we must arrange for more supplies.

4. In line with the central government's directives, while emphasizing assistance to agriculture, we must at the same time coordinate the production of chemicals with the needs of the light and heavy industries, particularly with regard to assisting the weaker sectors of these industries.

5. We must fulfill our objectives in export. Imports must be scrutinized and reduced as much as possible to conserve foreign exchange. When imports are absolutely necessary because domestic production is inadequate, we must do our best to import raw materials and further process them internally.

6. As for the chemical products made by small native and small modern group plants, we hope all consumers will take the attitude of trying to use them. Prices should be established on the principle that conditions for various products vary according to place, and consideration should be given to promoting the development and improvement of small plants.

7. We must have the cooperative spirit of communism in establishing a stable relationship in supply and demand--first others then onesself, hard on onesself, but lenient to others, help each other, discuss mutual problems, and strengthen cooperation."

We believe that under the correct leadership of the Party and the Central Government and the reflection of the Party's main line, we can surmount all difficulties and continue to leap forward.

4. An Innovation in Synthetic Ammonia Production

Page 25 (excerpts) Unsigned article

Under the reflection of the main line and close cooperation among Soviet specialists, supervising cadres, workers, and technicians, the addition of cylinders to the 1G Compressor has been successful on an experimental scale at the Lanchow Chemical Plant. This is an innovation in synthetic ammonia production. Ten-odd days of testing showed good results, as attested by Soviet specialists. According to calculations from actual tests, the addition of cylinders to an 1G Compressor enabled ammonia production to be increased by 12 metric tons per day.

Calculated on the basis of standard atmospheric pressure, the designed intake pressure for the 1G Compressor is 1.02 kilograms per mm^2. However, because the atmospheric pressure is lower than standard in the Lanchow area (only 634 mm), the actual intake pressure for the compressor in this area reaches only 0.85 kilograms per mm^2. Thus, the potential of this piece of equipment could not be fully utilized.

5. Nation-wide Record Again Set in Installation of IG Compressor

Page 26 (excerpts) Chang Kao-p'eng

The IG Compressor is a large double-row type 6-section piston compressor, which requires a high level of technique to install. The outside length is 16 meters, width 8 meters, height 4.5 meters, total weight 300 metric tons, and the largest spare part is 28 tons. When one was installed in Kirin, it took 80 days. During the leap forward year of 1958, the staff and workmen of the Lanchow Chemical Plant put one in in 28 days and thus established a national record.

Installation of this IG Compressor was one of four major measures undertaken at the Lanchow Chemical Plant to rapidly increase the production of synthetic ammonia. Its being tested and brought into production has been of great significance in raising synthetic ammonia production to the extent that the 1959 targets will be fulfilled 10-15 days ahead of schedule.

6. First Stage Experiments With the 400-Ton Per Year Synthetic Ammonia Plant

Pages 42-45 (excerpts)

Chemical Industry Design Institute and the Peiping Chemical Research Station

Ever since the East China Design Institute Branch designed the 400-ton per year native method contact sulfuric acid plant, many areas have subsequently constructed such plants and brought them into production. According to the directives of the Ministry of Chemical Industry, the Chemical Industry Design Institute and the Peiping Chemical Research Station jointly established an experimental 400-ton per year contact sulfuric acid plant and made a series of necessary tests with a view to helping native plants to surmount technical, economic, and equipment barriers. After two months of designing, construction, and preparatory work preceding production, airing and pre-heating were started on 1 July, catalysts and ore were charged on 3 July, and the first batch of satisfactory grade concentrated sulfuric acid was successfully produced on 5 July. For the following six days, average daily production attained design levels (1.3 tons per day) and the maximum daily output reached 1.7 tons.

Production Flowsheet and Equipment

The main equipment and specifications are as follows:

1. Lump ore furnace--built with red brick, lines inside with a layer of refractory brick (125 mm thick), wall thickness totals 500 mm. There are 4 hearths, each with a furnace bed area of 1,200 x 800 mm. The total furnace bed area is 3.84 square meters. The height from the grate to the arch is 1.15 meters.

2. Broken ore furnace--also built with red brick, lined with refractory brick (125 mm thick), wall thickness 500 mm. Furnace bed area is 1,200 x 800 mm.

3. Filtering room or chamber--lined with 125 mm thick refractory brick. The inside cross section area is 800 x 700 mm, From top to bottom, there is the limestone filtering layer, the glass wool filtering layer (50 mm thick), and a silica glue filtering layer. Between the last two layers is installed 6 ϕ $2\frac{1}{2}$" "air-can-pass" cooling pipes (during the experimental stage, limestone and silica glue were not put in).

4. No. 1 converter--made of 3 mm thick steel plate, inside diameter 650 mm. Vanadium catalyst is placed inside; its height is 270 mm; the volume of the catalyst is 0.09 m^3.

5. No. 2 converter--made of 3 mm thick steel plate, inside diameter 850 mm. Vanadium catalyst placed inside; its height is 300 mm; the volume of the catalyst is 0.17 m^3.

6. Sulfur trioxide cooler--"lin-hsi type" ϕ100 mm cast iron pipes connected in two rows, each row has straight pipes of 12 meter length, water trickling facilities are installed.

7. Absorption tower--made of steel plate, 600 mm diameter, 5,520 mm high. Inside is constructed 50 x 50 x 7 porcelain rings in 4 layers, on top is placed more 50 x 50 x 7 porcelain rings at random, the thickness of the large ring section is 3.5 meters. On top of this is further placed at random 25 x 25 x 3 porcelain rings, which aggregate 730 mm in height.

8. Filtering equipment (filter)--made of steel plate, diameter 650 mm, height 1,000 mm. Inside is put 25 x 25 x 3 porcelain rings (170 mm in height) and broken 50 x 50 x 7 porcelain rings (330 mm in height).

9. Blowing machine (blower)--made according to blueprints of the East China Design Institute Branch, air volume 500 m^3 per hour, air pressure 350 mm, main shaft speed 2,860 rpm. Auxiliary motor 2.8 kw, 1,430 rpm. Triangular shape belts used.

10. Chimney--made of 219 mm diameter seamless steel tubes, total height 24.5 meters (we used waste materials to make this).

11. Acid cooler--lin-hsi (water trickling) type, made of ϕ57 x 3.5 mm seamless tubes, total length of straight tube or pipe is 32 meters.

12. Acid pump--silicon steel pump KH36/27 type. Originally 12.5 kw and 1,450 rpm; converted to electric motor 10 kw and 970 rpm.

13. Cycling acid container-- ϕ620 x 850 mm ceramic material with volume of about 0.2 m^3.

14. Acid storage container--made of steel, ϕ2,000 x 2,350 mm, total volume about 7.4 m^3.

15. "Ngo type" crusher--intake opening 150 x 100 mm, 380 rpm. Auxiliary motor 1.7 kw and 1,430 rpm.

Conclusions

1. Experiments prove that by the native contact method the concentration of the sulfuric acid produced can meet specifications, and output can reach or surpass design capacity.

2. The capacities of the various equipment selected in the system basically are well balanced.

3. On the average the catalyst needs to be screened once in 7 days for the No. 1 converter; if dust elimination operations were strengthened, this interval could be lengthened.

4. There are more disadvantages than advantages in using the broken ore furnace in first stage conversion.

5. Within the SO_3 cooler, acid mud is precipitated, which apparently cannot be avoided.

6. The intake temperature for the No. 1 converter did not reach 420° C so that the conversion rate is low and consequently ore consumption is high.

7. Gas leakage is severe in the "brick built" broken ore furnace and filtering room.

8. The rate of sulfur burned out of the ore is very low, and ore cost represents 64% of the sulfuric acid production cost . If operations were improved to reduce ore consumption, cost could be greatly reduced.

9. The mine-run ore of the Ying-te [mine] contains half or more fines; these fines cannot be utilized and acid cost becomes high. A solution must be found. One way is to have the mines supply uniform lump ore (no fines); another way is to investigate the feasibility of briquetting or agglomerating the fine ore.

10. If the ore supplied by the mines is all in large lumps, then the crushing cost or work becomes great. It is necessary to have a small "Ngo type" crusher.

VI. ARTICLES FROM ISSUE NO. 23, 6 DECEMBER 1959

1. Present Essential Tasks in Chemical Research and Design Work

Pages 2-5

P'eng T'ao, Minister of Chemical Industry, at National Conference on Chemical Research and Design, 16 November

Chemical research and design work are the advanced forces of the chemical industry. They must be closely coordinated with production, leading the way for production and serving production. Thus, while arranging next year's work it is also necessary to consider the work for many years thereafter. Under the present "Leap forward" program and considering the needs for developing the chemical industry, the essential tasks in chemical research and design work include the following aspects.

A. Continue to Make Technical Improvements to Sustain the High Tide of Production

The main tasks in next year's industrial front are technical improvement and technical revolution. We must promote the "three combined" formula in having special research groups, design organizations, and the great masses work together so that plants, schools, and other groups will all be participating in research and design work with a view to simplifying flowsheets, improving techniques in operations, reducing raw material consumption, economizing on supplies and equipment, strengthening mechanization, cutting down on hand labor, etc. We hope all units will carefully study the problem as to how to work together in carrying out efficient research. Many new innovations have been made in recent years, their common characteristic being an attitude towards overcoming superstitions and doing away with old methods.

B. Fully Support the Small Native Group and Small Modern Group Movements

We have accomplished much in this line during the recent National Conference on the Chemical Industry. We should take note that at present some research and design personnel still do not think much of the small native and small modern groups and say that these enterprises are too small to be economic and cannot survive the future. These thoughts are strange. We are a socialist country rather than a capitalist country. Although products made by the small plants are not economic enough, the big plants cannot live without the small ones. Many small plants can be developed at a rapid pace. For example, recently the chemical and ceramic plants of Shanghai and Yi-hsing made a thousand units of 400-ton

per year small contact sulfuric acid plants, which in aggregate have an annual capacity of 400,000 metric tons. These plants can be brought into production very quickly. Another example is the 4,000-ton per year contact sulfuric acid plant, which requires a construction time of only 3-4 months. Thus, medium and small enterprises have their advantages. Of course, large plants also cannot be ignored.

In the last year or so we made great achievements in the small native and small modern groups, but we also learned some lessons. The most important problem is that these plants do not surmount technical barriers fast enough; we must find the cause. I believe that as long as the theory is the same, there is no reason why small plants cannot be successful technically if we spend the effort. Therefore, we should fully support the small plants.

C. Research Results Should be Quickly Applied to Industrial Operations

Since last year, as a result of the great efforts of the masses in "daring-to-think, daring-to-speak, and daring-to-do," many new important products not hitherto successfully investigated are now made and, in fact, techniques are often improved. For example, we have now produced polyvinyl tri-fluorine chloride, poly ethylene tetrachloride, and various types of nylon products. In this year, we have exchanged research experiences with foreign countries in many fields, which reflects the great progress in our work. This is a happy development. However, we must also realize that there is still a great gap between laboratory research and industrial application. Our present problem is how to reduce this gap. Of course, in certain fields our progress is not slow; but we should not be satisfied so easily. Experience in the last few years shows that we should follow the following lines:

1. Conditions permitting, various organizations can establish small machine shops to make the necessary equipment and spare parts. At present, the Peiping, Shanghai, and Mukden Institutes have already established such facilities. There are many advantages. Generally speaking, the supplies and equipment needed by various research organizations to accomplish this objective are not great so that when the organizations have the support of the provincial, city, and other local groups, construction can be rapidly completed. Through cooperation among various research groups in the country, the equipment and spare parts needed in research by any specific group can also be more easily made.

2. The research groups can have their own testing plants. More important however is the close cooperation with industrial plants so that experimental results can be put to greater use. This is a "two-legged" policy to rapidly transform laboratory work to industrial application. As for the testing plants, the scale should not be too large

and they should serve multi-purposes for further research in other products and processes.

3. Experimental facilities should be enlarged under certain conditions so that they might in fact be used for production. When expanding the scale of testing, it is not merely a matter of finding more design data; the testing facilities might be transformed into small scale plants of model quality that can be widely applied. The expanded experimental work done jointly by the Shanghai Pharmaceutical Research Laboratory and Industrial Plant was very successful and should be copied elsewhere. Experience proves that when experimental facilities are expanded to a production scale then, as far as the industrial plant is concerned, these facilities can be considered as small auxiliary production units; in this manner, the industrial plant is more willing to cooperate. Through this kind of arrangement, not only will industrial plants benefit greatly but the gap between experimental results and industrial application can be very rapidly reduced.

D. <u>The Policy of "More, Fast, Good, and Economical" Must be Applied Along the Whole Front of Design Work.</u>

In the last two years, because of the measures taken such as using common designs and simplifying design procedures, we have been able to accomplish a great deal. However, we must consider how to further improve efficiency. Not only must design work be "more and fast," but subsequent construction work must also be "more and fast"; not only must the quality of design work be good, but it must also be carried out on the principle of economizing as much as possible. What more can we do? I feel the following methods are worth considering. For example, by using the present plants as blue prints (for example, many chemical plants in Shanghai, Tientsin, and elsewhere) and making certain modifications, new designs can be developed; schools can be assigned design work; methods of improving materials and equipment in designing can be simplified; and characteristics particularly pertinent to China should be adopted in design work. In the field of alloy steels, we should use more of the well known minerals produced in our country--manganese, molybdenum and tungsten (the Chemical Machinery Research Station should do more research in this line). In addition, it should be pointed out that in using more nonmetal materials the purpose is not merely the saving of steel materials but also the recognition that many nonmetal materials have definite favorable characteristics.

Generally speaking, our past work in designing has achieved the objective of economy, as for instance the design of synthetic ammonia sulfuric acid plants, etc. Our funds are not large for next year, and we must still economize. However, in economizing we must not save what we should not save. For example, in the mechanization aspects of design, we should plan construction in stages when funds are not adequate rather

than dispensing with mechanization so as to make savings. Small native group plants can be quickly built, but they require relatively more manpower. Therefore, mechanization should be considered under certain circumstances. Past experience shows that sometimes it is necessary to emphasize economy and sometimes, quality. The general line, however, should be "more, fast, good, and economic."

E. Items of Work That Must Be Carried Out in Research and Design

1. Insist on political leadership, carry out the anti-rightist fight to the end. We all know that the 1942 rectification movement at Yenan had a determining effect on the success of the Chinese revolution. Similarly, the Party's great rectification movement this year in carrying out the "two-legged" policy will have a determining effect on the success of our country's socialist construction. Rightist thinking in the Party must be wiped out. Party members and masses alike must more fully understand socialism and communism.

2. Continue to encourage "thought liberation, and dare-to-think, dare-to-say, and dare-to-do" concepts. Since last year's great leap forward, as a result of encouraging "dare-to-think, dare-to-say, and dare-to-do," the research and design "army" has developed a new spirit. No matter how difficult problems may be, everyone "dares to do" once they see the reason for it. Final products are made, with only a little knowledge to start with. This kind of wonderful phenomenon could not be visualized two years ago. However, during part of this year, many people became less aggressive in their thinking and work and some even blamed temporary failures on last year's work; these concepts are entirely wrong. We should realize that daring to think and do does not mean that no faults will be found at all. More important, is the "main flow." The "main flow" carries with it the spirit of invention so as to assure the rapid rate of socialist construction. In our country, many things have attained international standards, as a result of the communist attitute of "dare-to-think, dare-to-say, and dare-to-do." We must have ambition and carry this attitude further.

3. Encourage the great cooperation of communism. In the last two years many research and design organizations have been established all over the country, and many plants and schols have become part of our research and design "army." One of the reasons so many accomplishments have been made in this period is the great cooperation of communism. Results prove that when there is good cooperation our strength is great even though technical personnel may be inadequate. This great cooperation is very important for it minimizes duplication of work. When one product is successfully investigated in one place, other places need not study it and can devote their efforts to research in other products.

To further strengthen and expand the research and design force, we believe in the method of training at different levels. The research and design organizations of provincial, city, or autonomous region levels should send a definite number of technicians to central government research and design organizations to receive training, and in turn take in for training people from the special district and hsien levels. Although this method does increase the original number of people, a new pool of techniciansis trained. We must overcome the concept that technical work is so deep and not understandable. Since the number of college and medium-level technical school graduates is still small, we cannot rely on these graduates alone. We much establish our own training classes to gain strength from the bottom up. Many high school graduates after two or three years of actual work attain a technical level much higher than graduates of medium-level technical schools and in fact reach the college graduate level. Therefore, if we take the correct mass line, we can rapidly expand our army of technicians.

4. The mass drive in the research and design front. To make this successful, we must muster the strength of all related plants and schools. One of the major problems still to be solved is to straighten out the thinking of some people who have doubts as to the wisdom of this mass drive.

Finally, I want to say that in the last year or so, because the contacts between the various research and design groups have been relatively limited, only some opinions are voiced. Today, many people representing many areas and organizations are attending the meeting, which fact alone shows that our research and design "army" has been greatly expanded. Two years ago, we would not have thought that such a rapid rate of advance was possible. In the past, the help given by the research and design institutes of the Ministry to similar local organizations has not been adequate. We must fully develop the potential of the local groups. Of course, the functions of the local organizations must be patterned after local characteristics, particularly local resources (gas in Szechwan and integrated chemical industries in Shanghai and Tientsin, etc). This is an important consideration in further development which we must carefully investigate.

In addition, it is necessary to emphasize the package concept in research and design work. If attention is only paid to the main parts and not the auxiliary and spare parts, problems will be encountered in production; the same is true with regard to research and design work. Experience tells us that the "problem of making up Sets" can be a difficult one. Therefore, the research and design organizations in both the central and local levels should pay particular attention to this matter. We must divide up labor, yet work together so that package work can be furnished.

2. Oppose Rightism, Arouse Diligence, Guarantee Overfulfillment Of This Year's Research and Design Work, Struggle to Achieve Ahead of Schedule Next Year's Greater Leap Forward in Chemical Industry Development

Pages 6-9 (excerpts)

Abstracts from report made by Vice Minister Li Su on 17 November at the National Conference on Chemical Research and Design

Vice Minister Li Su points out that in the chemical industry front, as a result of firmly carrying out the decision of the Eighth Plenary Session to oppose rightist opportunism and unfold a mass drive based on raising production while stressing economy, a new phenomenon of great enthusiasm has been developed. Production is steadily rising, and basic construction is being completed ahead of schedule. It is estimated that this year's production value for the chemical industry will increase more than 40%; meanwhile, during January to October inclusive, basic construction measured in terms of investment reached 73% of the year's quota and 276 engineering projects have already been brought into production.

Vice Minister Li indicates that chemical research and design work following the leap forward in production have also attained notable results in terms of scientific levels of political thought. Since 1958, as a result of carrying out the "two-legged" policy, the chemical research and design units have truly made science and technology serve production. Through good political leadership, thought liberation, and reliance on the masses, research and design work have done away once and for all the past reliance on a limited number of specialists. The ingenuity, hard work, and enthusiasm of the masses have resulted in many technical innovations and achievements. For example, the 800-ton per year small synthetic ammonia plant after a year's hard work has been finally brought into normal production; the 4,000-ton per year contact sulfuric acid plant using the water washing flowsheet has pierced the technical barrier; the 400-ton per year small contact sulfuric acid plant has been constructed in many parts of the country; much has also been achieved in the production of small butyl sodium rubber, polyvinyl tetrafluoride (experimental manufacture), color formation agents for color movies, etc. Meanwhile, our design units during the last year completed a total of 773 designs involving more than 290 products, or about 50 times the work done during the First Five-Year Plan period. These designs not only satisfied construction requirements, but also passed technical standards with regard to products made, such as synthetic ammonia, sulfuric acid, carbide, caustic soda, polyvinyl chloride, soda ash, phthalic acid anhydride, etc. Operating conditions have been good with regard to new techniques such as the distillation under pressure for polyvinyl chloride, the vertical absorption membrane

electrolytic cell for caustic soda electrolysis, high efficiency "Lieh-wen" evaporator, and the boiling (or flash) furnace for the promotion of phthalic acid anhydride. Meanwhile, the designs meant great savings in investment. For example, investment as compared with past practices declined 53% for synthetic ammonia, 60% for caustic soda, 75% for carbide, etc. Our research and design "army," following the rise in chemical production, has also steadily been enlarged and research and design organizations have been established everywhere in schools, plants, enterprises and independent organizations. A national chemical research and design base is taking shape, which is steadily growing in strength.

Vice Minister Li points out that 1960 is the further great leap forward year for the chemical industry. To assist agriculture, the chemical industry must greatly increase the output of chemical fertilizers, insecticides, etc. Agricultural machinery and rubber parts are also needed. Meanwhile, we must strongly support the expansion of the light, heavy, communications, and transport industries. Thus, the research and design responsibilities for 1960 are both great and glorious. We must carry out the Party's main line of mobilizing the masses for greater effort in research and design. To conform with the rapid advance in the chemical industry, the following problems in research and design should be particularly emphasized:

To assist agriculture as the most important objective, our research and design work should stress an improvement in tools for raising output of chemical fertilizers and insecticides and for bettering the coordination of agricultural machinery and agricultural transport; the supply of rubber products should also be emphasized. At the same time, to help light, heavy, communications, transport, and defense industries, we must strive to increase the number of new products and make up for deficiencies. To stabilize the technical base of the chemical industry, we must work on organic synthetic products such as synthetic rubber, synthetic cellulose or fiber, plastics, other synthetic materials, and "extreme" type of chemical products. In particular, we must next year establish a good record in the field of integrated utilization of resources and in model type experiments. For example, we must master techniques, make industrial scale designs, and prepare for the future development of industries like natural gas, coal, petroleum gas, rice stalks, sugar bagasse, "666 no poison body," alumstone, gypsum, etc. on an integrated utilization basis.

3. Organize Regional Cooperation, Accelerate a Collective Leap Forward In The Chemical Industry's Design Work

Page 10 (excerpts)

South-Central Chemical Design and Research Branch Institute

From March to August of this year, with our institute as the core, three conferences were organized among design units from five provinces (autonomous regions) in South-Central China. These conferences and the subsequent cooperative efforts assure the successful completion of the leap forward design objectives for all the units in this region. For January to October alone, 96 separate designs have been completed by the various units, which already meet this year's total quota.

This year's basic construction responsibilities for five provinces (regions) in South-Central China are very great, and the common characteristic is the lack of time and the urgent need. For example, in Kwangtung Province, there were simultaneously three items (of design) not originally designated that had to be started. On the other hand, the design capacity is generally weak--units have not been established for long, experience is lacking, technical levels are not high, and the design types are not complete. Under these conditions, it is very difficult to quickly complete large orders in design. In addition, because quality inferiority may call for relatively basic modifications, or the preliminary design is changed to the engineering design, the volume of work is generally increased.

4. Fully Exploit the Technical Capabilities of Plant and Schools; Carry on the Mass Drive in Design and Research

Pages 11-13

Southwest Chemical Design and Research Branch Institute

During the year since the establishment of the Southwest Chemical Design and Research Branch Institute, there has been a great leap forward in industrial and agricultural production and the chemical industry has flowered everywhere. In this glorious year, under the leadership of the Ministry of Chemical Industry and the Szechwan Province Chemical Industry Bureau, we have completed 59 designs of various types, carried out 19 items of experimental work, and performed 416 items of analyses. In addition, we have promoted and participated in the construction of experimental bases in the various gas fields. We also participated in the construction of the Ta-Yi Chemical Industry small native group experimental farm and in subsequent production work, and established 15 chemical plants making sulfuric acid, caustic soda, chemical fertilizer, and other products (14 of these plants have already surmounted economic and technical barriers). Furthermore, we have helped various related organizations to train 290 preliminary level technical personnel.

In completing the above described work, we deeply felt that our own personnel could not possibly have done so much. The method we used was to closely follow Party directives in mobilizing and utilizing all the local technical manpower (particularly the "strength" of plants and schools) and carry on mass type design and research work both within and outside of the Institute. Experinece has shown that the correct way in carrying out research and design work in line with the policy of "more, fast, good, and economical" is to overcome superstitions, push the mass drive, cooperate with various units and divide up the labor, and concentrate on developing local research and design strength. In this regard, we did the following major types of work.

1. Absorb and direct local technicians to carry out design work. In the last year for the 59 design items completed by our Institute, 16 were done through cooperation with local organizations; the contribution by local groups constituted more than one-fifth the total design work of our Institute. For example, 40 technicians dispatched by the Tzu-kung Chemical Industry Bureau and under the direction of our Institute carried out the design of the Tzu-kung Joint Chemical Plant and the Tzu-kung Soda Ash Plant. After this work and upon returning to Tzu-kung, these technicians became capable of independent design not only in work related to soda ash, caustic soda, and certain organic products but also in work dealing with extraction of inorganic salts from saline water. In addition, with regard to the design of nitrogenous fertilizer plants on the provincial level, we helped to develop the full potential (improve the design) of the Chungking Chemical Plant

and the 50,000-ton synthetic ammonia plant. Such work not only enables us to be of great assistance in generating more activities but also promotes the formation of a greater technical pool. The groups we help not only can lessen our burden in basic design and shoulder responsibilities in design related to plant expansion, but also can in turn assist us in new design work.

In addition to plants, we also cooperate closely with schools in joint design work. After giving the schools some technical pointers and explaining the major aspects of design, much of the work is ultimately done by the schools; we need only to check the final designs. Through the actual experience in design, the students learn the relationship between practice and theory, the fundamentals of methods of design, and how to work together in joint design work; and the professors have a chance to see how their teaching is turning out. This arrangement is good both for the schools and ourselves.

In order to have good cooperation with plants and schools, it is important to determine an appropriate method according to the conditions of the school or plant. When working jointly with plants, we should clearly explain that our combined effort not only will expedite design work but more important, will help train technical personnel for the plants. Once this is understood, the plants will give us great support. When working jointly with schools, we feel that, because the schools can only participate in joint work for short periods, we should select shorter and fewer design items rather than large scale design projects in order to achieve the best results.

2. Absorb the production experience of local plants or utilize already available designs and modify them in cooperation with the plants. In so doing, not only will design work be reduced but quality will also be assured; this is particularly true in the design of small native group and small modern group plants. For example, according to the experience of the Chengtu Pharmaceutical Plant in making glucose, after we wroked jointly to modify the design, the plant flowsheet became a model. Similarly, based upon the experience of the Ta-yi "Experimental Farm" in producing calcium magnesium phosphate fertilizer, we also worked jointly with the farm to come up with standard designs. Hereafter, we furthermore plan to cooperate with the Ta-yi group in formulating small scale native type plant designs to make "Hu-min acid salts" and acetic acid from "vinegar stone" (ch'u-shih); and cooperate with the Nei-chiang Special District Light Chemical Industry Bureau in design work connected with hydrolysis treatment of sugar bagasse to make furfural and to make glucose from corn and sweet potatoes, etc.

3. In cooperation with local scientific research organizations, universities and specialized technical schools, make overall plans and divide up the work in carrying our major aspects of research. For

example, in research work related to making formaldehyde from the oxidation of natural gas, there were formerly more than 10 groups in Szechwan duplicating many aspects of the work. In May of this year, our Institute called a conference for the province and assembled interested parties from the various research units, schools, and plants. We discussed how to work together in investigating formaldehyde so as to divide up the labor and avoid duplication. This action has had a very important effect on developing research.

In promoting local research work, we not only worked together with the local organizations but also gave them assistance in technology and materials. For example, an ethine experimental station was established jointly by ourselves and the Tzu-kung City Chemical Industry Bureau; our Institute sent some technical specialists and the Bureau furnished cadres and workmen; investments, materials, equipment and installation problems related to research were primarily furnished by the Tzu-kung Chemical Industry Bureau. In this manner, only a little over half a year was needed to start experimentation on ethine.

We have only started to do some work along these lines, but are determined to do much more. We intend to adhere to the policy of the Ministry of Chemical Industry to coordinate special research and design groups with the masses to carry out the 1960 leap forward objectives for the chemical industry.

5. How Our Province's Chemical Research Units Broadened Their Work

Pages 12-13 (excerpt)

Hsu Yi-ta
Kiangsu Province Chemical Research Laboratory

The year 1959 has been one of a great leap forward in the chemical industry of our province and 1960 will be a year of even greater progress. Under the leadership and support of central and provincial authorities, unparalleled development is taking place in our province's scientific research work. At present there are 10 special chemical research laboratories in the province, three large scale chemical plants which have fair sized laboratories, and various colleges and special technical schools which are undertaking research work along specialty lines. The technical improvement and technical revolution drive is also underway. Thus, a situation of numerous activities in chemical research by the masses exists.

Since this year the 10 special laboratories and the laboratories of 3 plants have carried out more than 200 research projects. In line with the spirit of the National Chemical Conference of March this year, much has been achieved in servicing production. For example, the Wu-hsi City Research Station has helped in improving techniques related to native contact sulfuric acid production. The Provincial Research Laboratory dispatched work groups to help complete research work related to the utilization of marsh gas for the Wei-ning Hsien WangOchi Peoples Commune, and research work on refining sulfur by blast furnace (productivity was raised 20 times) for the Nanking City Hsiao-hung-shan group, and in so doing also produced dilute sulfuric acid and ferrous sulfide. The Hsin-hai-lien City Research Laboratory, although only just recently established, also helped solve the rust prevention problem in silicon steel sheets for a transformer plant and, at the same time, saved much manpower. In addition, research work in various laboratories on many products, such as chemical fertilizer, insecticides, synthetic materials, and pharmaceuticals has resulted in intermediate scale production.

6. Rapidly Develop China's Chemical Industry, Coordinating Large, Medium, And Small Enterprises, But With The Medium and Small As The Core

Pages 14-16 (excerpts)

Notes from the National Chemical Industry Conference

In the leap forward of the chemical industry since last year, the basic experience gained from everywhere is: without the small native group and small modern group plants, advancement could not have been so quick. In Honan Province, there were only 34 chemical plants and mines at the end of 1957; as a result of promoting small native group enterprises, there are now 256 plants and mines developed by the chemical industry system at the hsien level or above. Production during January to September this year as compared with the similar period last year shows an increase of 12 times for sulfuric acid, 1 time for hydrochloric acid, and nearly 6 times for caustic soda; similar increases are noted for other products; most of this production is furnished by small native group and small modern plants. Several hundred small production units have also been established in Shantung Province in the last year. The yearly productive capacity is now 126,000 metric tons for sulfuric acid, 5,000 tons for hydrochloric acid, and 10,000 tons for soda ash. A year ago, the annual sulfuric acid capacity for Hupeh Province was only 3,000-odd metric tons; by the end of this year, it should reach more than 80,000 tons; the new capacity is entirely from medium and small enterprises. As a result of pushing the small native group movement in the chemical industry for Kansu Province, various special districts and hsiens all have medium and small scale chemical plants of different sizes. During January to September of this year as compared with all of last year, production of sulfuric acid has risen 11 times, soda ash nearly 14 times, caustic soda 2 times, and sulfur 4 times. In the Sinkiang Wei-wu-erh Autonomous Region, there was previously only one small sulfuric acid plant; as a result of pushing small native group plants, there have been developed 10 fields of chemical industries, including chemical ores, acids, alkalies, chemical fertilizers, inorganic salts, and rubber. In the Inner Mongolia Autonomous Region, the scale of the chemical industry doubled between 1957 and 1958 and again will triple between 1959 and 1958; virtually all the chemical industries are of the small or medium scale native type. In provinces and autonomous regions like Yunnan, Kweichow, Tsinghai, and Kwangsi, where the chemical base was either very weak or non-existent, many small chemical plants have been built since last year to produce badly needed products like chemical fertilizers, agricultural medicines, sulfuric acid, soda ash, caustic soda, hydrochloric acid, etc. Practice has shown that small and medium scale enterprises have definite advantages, hence their development will have an important effect on the rapid development of the chemical industry of our country.

The principal advantages of medium and small scale enterprises are:

1. Time required is short, normally within a year to bear fruit. Large synthetic ammonia, synthetic rubber, sulfuric acid, soda ash, and caustic soda plants need a year or more to build, whereas medium and small plants can be operating in less time. For example, a 800-metric ton per year synthetic ammonia plant can be built in a half year and in some cases even one quarter. It takes only 2-3 months to build a 4,000-ton contact sulfuric acid plant. The time needed to build small contact sulfuric acid, small calcium magnesium phosphate fertilizer, and small carbide plants is even less when close direction is given.

2. In constructing small and medium plants, investments are low, more nonmetallic materials can be used (saves steel materials), and the equipment needed is easier to make and hence its supply is easier to solve. In Heilungkiang Province during last year, it was nearly impossible to build a large carbide plant through limitations of equipment and materials. This year more than 10 small carbide plants have been built (in Heilungkiang) which have a combined capacity of about 20,000 metric tons per year, and the province is basically self-sufficient in carbide. In constructing an 800-ton small synthetic ammonia plant, only 900,000-odd yuan of investment and about 200 metric tons of steel materials (include equipment needs) are required. Anhwei Province has been very successful in building these small ammonia plants, and the equipment is essentially made in the province.

3. The construction of medium and small enterprises can make use of widespread resources, cuts down on long-haul transport, saves on wrapping and boxing, and more easily meets urgent local needs. The Honan Province Shang-chuang Chemical Plant successfully developed model units for commune chemical industries. This plant makes ten-odd standard sets of products of roughly three categories. One type directly services agriculture such as insecticides, turning belts, rubber hoses, etc.; a second type is related to integrated utilization of agricultural by-products such as furfural, acetone, methyl ethyl carbinol, starch, "pai-chiu" (white liquor), alcohol, sebacic acid, octyl alcohol, etc.; and the third type consists of basic chemical raw materials such as sulfuric acid, caustic soda, etc. The agricultural medicines produced are very effective in killing insects. In April of this year, the 2,400 square meters of rubber belt and 2,900 meters of rubber hose produced by this plant have assured the irrigation needs. The Szechwan Province Ta-yi Hsien Integrated Chemical Plant is also a model chemical industry plant built for agricultural needs. This plant in employing local ores and agricultural by-products produced chemical fertilizers, sulfuric acid, soda ash, glucose and other chemical products totaling more than 20 in number to effectively help agriculture, steel smelting, and in the receipts by communes. The Honan Province Shang-ch'iu Hsien Kwan-hua

Chemical Plant in the integrated utilization of local nitrate soil produced potassium nitrate, potassium chloride, nitrate salts, magnesium chloride, hydrochloric acid, etc. The potassium nitrate produced by this plant reaches 99.94% in grade, and the quantity represents a very important proportion of the national output of the product.

4. Techniques related to medium and small enterprises are relatively simple to master and technical personnel can be generally trained in practice. Prior to last year few people knew much about chemistry but, as a result of pushing small native and modern group operations (conferences, inspections, training with old workers, actual practice, etc.), a new chemical manpower pool has been developed. In the widespread development of small scale acid and alkali plants last year, about 45,000 workers capable of "independent operations" were trained. Last year, chemical workers in Sinkiang Wei-wu-erh Autonomous Region increased by about 10,000, chemical workers and technicians in Kiangsi Province each rose by about 4 times, and chemical personnel elsewhere also were rapidly developed--all primarily as a result of the small native and modern group movement. No such results could have been obtained if reliance were on academic institutions alone.

Generally speaking, small and medium scale enterprises are best for bringing out the utmost from the masses. These enterprises are capable of being developed everywhere by all the people. Although small plants have limited individual capacity, their combined capacity is sizeable; 500 small synthetic ammonia plants will have an aggregate capacity of 40,000 tons. Besides, small plants can be enlarged when conditions are favorable. Today's small plants will be tomorrow's large plants. The "two-legged" policy of also supporting small and medium enterprises is basic to rapid expansion of our country's chemical industry.

As for saying that production costs are high for small native and modern group plants, we have to determine the basis of comparison. Compared with costs at large plants, it is understandable that they are higher. However, when one considers transport costs for long hauls, then the net costs may well be lower. For example, a ton of sulfuric acid from Nanking delivered to Kunming would cost about 1,000 yuan, whereas that produced by local native plants would be only 300 yuan at the most. Besides, costs for small plants will gradually decrease upon mastering techniques and making technical improvements. A case in point is sulfuric acid where costs for many small contact plants have dropped from 700-800 yuan per metric ton to 200-odd yuan. As for some urgently needed chemical products, although present costs are a little higher, over-all accounting shows that they are worthwhile from an economic viewpoint since they not only meet urgent agricultural leap forward needs but, through their production, the foundation for further development of the chemical industry can be firmly established.

7. Develop Basic Construction Along With Production, Instigate Mass Movements, Fulfill Basic Construction Quotas Ahead of Schedule

Pages 18-21 — Fu-chou Chemical Plant No. 2

Our plant was conceived during the industrial and agricultural great leap forward year of 1958. As a result of firm political leadership, the mass drive, overcoming the sacred feeling towards chemical industry development, carrying out the policy of gaining strength from within, native-modern combined, and walking on two legs, and constructing while producing, various difficulties were overcome and basic construction moved at a rapid pace. Within the half year period from September of last year when construction was initiated and March of this year, the caustic soda, chlorine and "666" units were completed ahead of schedule and broughtinto experimental production.

Since August of this year, stimulated by the slogan of the Eighth Plenary No. Eight Session to "oppose rightism, arouse diligence, raise production, and economize," our plant suggested another slogan "work hard in August and September, complete the caustic soda unit to welcome the National Celebration." Through a high work spirit, basic construction and installation quotas have been overfulfilled each month. August performance was 76% above that of July; September 169% over August; and the third quarter performance 185% over that of the second quarter. The basic construction and investment quota for the whole year was overfulfilled by 17% a quarter ahead of schedule.

Combine Native and Modern, Arm Ourselves

Our plant met many difficulties in basic construction, particularly with regard to the supply of materials and equipment. Forexample, by native construction methods we needed 800 metric tons of steel rods but we only had 50 tons; we needed 4,000-odd tons of cement but we only had 300 tons; the supply of brick, tile, wood, bamboo, and other materials was likewise inadequate. To expedite construction, we mobilized the whole working force to overcome the materials and equipment shortage problem and adopted the "native modern combination and gaining strength from within" method in modifying design, conserving materials, employing substitutes, and in general arming ourselves to pierce the materials barrier.

With regard to the structure and construction of plant buildings, under the conditions of assuring production and conforming with safety requirements and with the approval of design divisions, we changed a number of concrete buildings to brick-wood combination structures. With regard to materials substitution, we used porcelain to substitute for steel and wood to substitute for steel and granite to substitute for

acid resistant cement. Meanwhile, we established by ourselves native method cement plants and made low standard cement; and we set up porcelain units which produced nearly 2,000 pieces of porcelain pipes, more than 600 hydrochloric acid containers, and 27 pieces of chemical equipment. We constructed a machine shop to make tools and equipment and train technical personnel; this shop made for the soda, chlorine, and "666" units alone 48 items and 99 units of equipment. All these activities have had an important effect in expediting basic construction. With regard to conserving and saving of materials, for 4 months of last year alone, there were 800 suggestions for improvement by the workers which resulted in saving 300 tons of steel materials, and 500 tons of cement so that construction was expedited and production was started earlier. Meanwhile, we also thought of every means to solve materials, equipment, and meeting schedule problems for large projects (such as evaporation, salt water, alkali fixation, polyvinyl, and other units) so as to meet the national quotas for key projects.

Push Native Construction and Installation Methods to Attack Key Problems

In the electrolysis units, we assumed the responsibility of making and installing Hooks electrolytic cells. Through the training while operating process of technical revolution, we overcome technical obstacles such as the low lead of the anodes and anode membrane adsorption problems. Because of the difficulty of supplying carbon plates, large carbon plates were interspaced with small carbon plates when the anodes of the electrolytic cells were built and this meant savings of a ton and a half of carbon plates. Since there was no electric hoist, a wooden "lung-men" (dragon gate) native hoist was made and in three days 60 electrolytic cell anodes were installed at a savings of 35,000 yuan. Through these measures, the material shortage difficulties were surmounted and construction responsibilities were fulfilled on time. Many similar examples can be found in all other units.

Although production facilities were completed ahead of schedule, the problems of water and electricity were not yet solved so we had to adopt some temporary measures. The rectifying station did not have a 35,000-volt power source so we substituted a 6,600-volt system; a 10-ton boiler was not completed so we installed 1-ton boilers for steam; the water supply problem was not solved so we utilized pond water and recirculated water. All the existing supply and operating departments worked together to help the three principal units get ready. On the eve of the trial run when there was a heavy downpour of rain, we had to install a lightning rod; to meet the raw material needs for the trial run, workers had to work day and night to transport salt; to compensate for the labor shortage, office cadres had to lend a hand in dirt filling and transporting materials; to expedite the making of pipe supports, the entire corps of cadres went several li to bring in lumber. With united determined action from top to bottom, we were able to start the three principal units on their trial runs a half year ahead of schedule.

Coordinating Central Leadership With the Mass Drive

With united action, we strove for the goal of making production trial runs on all fronts by 10 October. To centralize direction and expedite basic construction, a project direction crew was organized at the plant site. When leadership was consolidated, mass efforts became more effective. Construction and installation work was pushed night and day, with whatever means at hand, including native methods. Tool shortage problems were solved as quickly as possible. When materials and equipment were inadequate, supplies were directed from elsewhere to assure smooth operations in construction.

Supervisors personally went to the front to grasp the key points, correct weak aspects, and strengthen the supply of tools. With regard to the caustic soda project, the Party representatives divided supervision into six fronts, including native construction, installation, water-power-steam, production, and others, with "secretary," superintendent, and division supervisors going to the front lines to tighten construction work and solve problems as they occur. For example, in the work of installing posts in the evaporation project section (originally a weak link), progress was slow and only 8 posts were installed in a two-shift day. After supervising comrades thoroughly examined the problems, called on-the-spot meetings, strengthened thought education, and made adjustments in the shifts from two to four, the efficiency of post or foundation installation was greatly raised--from 8 a day to a record of more than 30.

By organizing various types of work into "vertical intersecting" parallel flowing operations," work times are greatly reduced. Take the example of the plant structure or building for evaporation. As soon as the native method wood workers completed half of the first flight, "steel rod workers" immediately cleaned the boards, put in the lines, and started to tie up the steel rods. When the caustic soda project's main plant buildings (evaporation, alkali fixation, and salt water) were basically completed, there remained much clean-up work and miscellaneous installation jobs to be done. We immediately examined clean-up items to be done, made schedules and time limitations, and adopted the method of cleaning up one place at a time; within a month the entire miscellaneous work was completed.

In carrying out the work, we deeply felt that the mass drive and the drive to improve technology were very important in expediting operations. The "Red flag" contest movement aroused the masses to great efforts; work was carried out even in storms. To complete the work ahead of schedule, the workers and staff wanted to reward to work extra shifts and refused to stop work when slightly hurt. Examples of this kind are numerous. Thus, work was accelerated. The 21.6-meter high 4-section concrete structure for the evaporation section was

completed in 23 days, or 12 days less than the planned time. The alkali fixation plant building (a combination structure) was built in 23 days, and a 45-meter high chimney (made of brick or stone) required only 35 days. For all the native style constructed projects, the actual construction time was reduced by about two-thirds.

The installation work for evaporation, alkali fixation, salt water, and exterior pipe supports were started during the first and second ten days of September. However, equipment and pipes were delayed in delivery and some were still arriving by the last ten days of September. Time was recaptured by the workers through accelerated rates of installation. In fact, except for some special pieces of equipment which had not yet arrived, installation work had nearly been completed by the end of September. Records were established in all lines of work. The pipe crew established an installation record of 120 meters per shift and within a month completed installation of more than 8,000 meters of pipe. The alkali fixation unit brick layers used 15 days and 990 man-days to complete the work originally planned to be done in 35 days and 1,990 man-days. During the accelerated work program in August and September, apprentices of various units greatly assisted installation by native methods and effectively expedited the over-all work progress. For example, for the caustic soda unit, the manufacture and installation of electrolytic cells for the "7,500" project was completed with flying colors; the engine and motor section technical cadres and 100-odd apprentices worked hard for a little more than a month to dig 3,000-odd fang /cubic meters?/ of dirt to install several thousand meters of electric cables. In addition, about 2,000 meters of water pipes were successfully installed by apprentices.

Training of Technical workers

The technical manpower pool of our plant was very weak. Aside from one chemical engineer, several high school chemistry teachers, and one old experienced worker, all others were young apprentice workers. However, workers were trained as they worked. Through promoting the technical drive, not only were many key problems in construction and production solved, but workers also learned to master techniques. For example, even some women workers who used to cry when encountering difficulties gradually learned fortitude along with techniques.

The production cycle was long and the coal consumption great for the alkali digestion section. The workers and staff after learning the experience of the Chekiang Ta-t'ung Electro-Chemical Plant reduced the salt digestion time from the original 3 days for one pot to 27 hours, and coal consumption from 6,000 kilograms to 1,600 kilograms. For the synthesis furnace of the chlorine unit hydrogen chloride section, only 3 apprentices knew how to light the fire; at the beginning, production of hydrochloric acid was low and its quality not stabilized. Through

joint investigation by supervisors and workmen, introduction of corrective measures, and organizing contests, production has gone up day by day and present daily output of hydrochloric acid more than doubles the rate when operations first started. Moreover, more than 90% of the workers working at this section have since learned the technique of lighting the fire. In the liquid chlorine section cooling and freezing subsection, work was often stopped because the temperature of the cooling water was too high; this affected the production of "666." Operating techniques have since been greatly improved.

In the last year, not only have we overfulfilled construction objectives but we have also achieved great success in production. Since making the trial runs for the three main units in March, production has become normalized and product quantity and quality have been steadily raised. The output quota for the third quarter has been more than fulfilled.

Our plant has achieved great success--a success for Party supervision, for the main line of socialist construction, and for the mass emulation drive. On the foundation of this success, the workers and staff of our plant are determined to do even better in the fourth quarter and in 1960.

8. Production Rises Step by Step, Joyful Messages Steadily Flow In

Page 22 (excerpt) Unsigned article

Intermediate Scale Testing of Urea Has Made Great Progress

Intermediate scale urea testing is making rapid progress under the Nanking Chemical Industry Company. Average daily output in October was raised 85% over the average rate for the third quarter, costs reduced 32%, and "consumption quota" (for materials) lowered by 57%; the test plant is working according to design standards. On the 8th and 9th of November, output exceeded design standards. With regard to product quality, aside from a high water content on account of the fact that drying equipment has not yet been installed, all other specification standards are equal or better than the Soviet GOST 2081-57 standards. The company is currently strengthening research and testing work and striving to surmount the technical barriers of the "semi cycle method" in order to satisfy actual production requirements.

The Hofei Chemical Plant Carbide Unit is Starting a Technical Improvement Drive to Save 60,000 yuan in a Year

The Anhwei Hofei Chemical Plant carbide unit has carried out two items of technical improvement--reduced the grain size of raw materials and substituted some of the coke needed for making carbide by anthracite so that yearly savings to the country would be 60,000 yuan.

Further modifications of equipment and operations are being investigated. Work is done in electric welding of electrode shell without stoppage of operations so as to increase the utilization rate of equipment. Investigations are being made with regard to improving operations so as to raise output and better product quality.

Assure Delivery Ahead of Schedule to Help the Country's Great Leap Forward

The more than 60,000 staff and workmen in the chemical industries of Shanghai have agreed to a "supply contract" to assure achievement of national production goals. More than 32 types of chemical products will be delivered 10-30 days ahead of schedule.

Chemical Units in Various Parts of the Country Are Producing For 1960 Ahead of Schedule

Chemical production in Hopeh Province attained quotas one month and nine days ahead of schedule. Preliminary estimates show that output for the whole year will be 20% more than the quotas and 60% more than actual output in 1958. There is no doubt that this is a great

achievement. For cities in the province like Shih-chia-chuang, Pao-ting, Chang-chia-k'ou, etc., the 1959 targets were achieved more than two months ahead of schedule.

Up to the middle ten days of November, production of 15 major products in Shangtung Province had already surpassed the whole year's targets. These are: carbide, superphosphate, acetanilide, pyrite, sulfur, hydrochloric acid, lead sulfate, phenol, tires and tubes, belts, bicycle tires, rubber hoses, "triangular belts," potassium nitrate, and "ch'ien-tan" (a lead product). Among these, output of potassium nitrate was 67% above quota, triangular belt" 87% above quota, and rubber hose 65% above quota. For Tsingtao and Tsinan cities, the year's over-all output value quota for chemical products had been fulfilled respectively 55 days and 46 days ahead of schedule.

In the Wei-wu-erh Autonomous Region of Sinkiang Province, sulfur and caustic soda production exceeded the whole year's quota by 120.86% and 108.9%, respectively, 60 days before the end of the year.

The Dairen Dyestuff Plant attained its 1959 production quota 49 days ahead of schedule. Not satified, the staff and workmen then strived to attain the "raise production make economy objectives" 42 days ahead of schedule and their own leap forward goals 37 days ahead of schedule; they also intend to make good preparations for 1960.

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